

TIME TO INVENT™ CLUB

A 16-week program for 5th graders



TIME TO INVENT is funded by
the **Lemelson** foundation
improving lives through invention

TIME TO INVENT CLUB

A 16-week program
for 5th graders



© 2010 WGBH Educational Foundation. TIME TO
INVENT CLUB and associated logo are trademarks
of WGBH Educational Foundation.

the **Lemelson** foundation
improving lives through invention

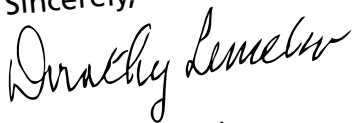
Dear Mentor:

Welcome and thank you for becoming a mentor for the *Time to Invent™* club. We are excited about your role in providing students with a supportive guide and a helping hand to understand invention and engineering. We know you will enjoy working with these young people who previously may not have had role models in engineering and other science-related fields.

The work you will be doing with the *Time to Invent* club is core to The Lemelson Foundation's mission. Our founder, Jerome Lemelson, believed that, working together, we can create innovative solutions to everyday problems and improve lives in the process. Projects we support help youth—like those you will be mentoring—to engage their sense of scientific curiosity and wonder so that they can become the inventors of tomorrow.

We are delighted that you will share your expertise with *Time to Invent* club members, and we hope the challenges and activities outlined in this guide will help you bring invention and engineering to life for these young people.

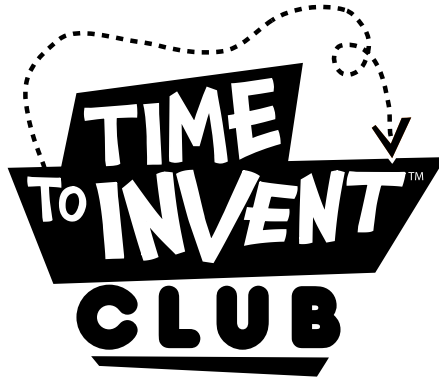
Sincerely,



Dorothy Lemelson
Chair



Julia Novy-Hildesley
Executive Director



Welcome to the *Time to Invent* club! Designed for fifth graders in afterschool programs, the club uses fun invention challenges to spark kids' interest in science, technology, engineering, and math (STEM). It also connects them with STEM role models.

By doing the challenges in this guide, kids will learn how the design process helps them with creative problem solving and what inventing is all about. As kids learn to think like inventors, they'll grow confident in their abilities, maybe even seeing science, technology, engineering, and math as exciting pathways for their own lives.



The Time to Invent club uses fun invention challenges to spark kids' interest in science, technology, engineering, and math (STEM).

Contents

GETTING STARTED

Running a <i>Time to Invent</i> Club	1
Finding a STEM Mentor or an Afterschool Partner	2
Roles and Responsibilities of the Mentors and Afterschool Leaders	5
Guide Components	6
Invention and the Design Process	8
Talking with Kids about Invention	9
Tips for Leading Open-Ended Challenges.	10
Effective Mentoring.	12
Master Materials List	14

CHALLENGES

Meeting 1: Club Launch & Welcome Welcome kids and do some mini-challenges.	17
Meeting 2: Trophy Tower Make a strong structure out of straws.	23
Meeting 3: Hit the Target Explore levers by making a ball launcher	33
Meeting 4: Paper Bridge–Paper Chair Use folds to make paper stronger	47
Meetings 5 & 6: Green Loungers Design and build chairs out of cardboard.	57
Meeting 7: Buzz Board Learn about circuits by making a buzzer game.	73
Meeting 8: Show & Tell Celebration Present projects to others in the afterschool	85
Meeting 9: Rapid Response Solve a bunch of quick invention challenges	93
Meeting 10: Rescue 911 Invent a tool to rescue a ball from a tube.	105
Meeting 11: Pinball Party Invent a pinball-like game.	113
Meeting 12: Newspaper Clothes Design and make outfits from newspaper.	123
Meeting 13: Circuit Board Invent a game to teach other kids about circuits.	133
Meeting 14: FUN-Raising Games Invent carnival games, using some wacky equipment.	143
Meeting 15: Game Day Test the games with other kids in the afterschool.	159
Meeting 16: Finale Celebration Present the projects to other kids in the afterschool.	167

APPENDIX

Letter to Parents About Receiving Weekly Communications (English and Spanish)	171, 173
Text/E-mail Messages (English and Spanish).	175
Ways to Keep Inventing (Invention Resources) (English and Spanish)	181, 183
Education Standards	185
Membership Cards	187
Certificate of Achievement (English and Spanish).	189, 191
Mentor Certificate	193
Credits.	195

Running a *Time to Invent* Club

All that's needed to run a *Time to Invent* club is a partnership with a local afterschool program; a pair of science, technology, engineering, and math (STEM) professionals or students; a large workspace; and some low-cost materials. This guide makes it easy to launch a club, get kids excited about the invention process, and stimulate their interest in STEM.

Mentors and the afterschool leader run the club together

The club activities are led by two mentors who are STEM professionals and/or college students in STEM fields of study. The mentors are assisted by an afterschool leader who knows the kids and their families and who can provide support and can coordinate on-site tasks, such as recruitment, room assignments, communications with families, and classroom management.

Scheduling the time

For a meaningful mentor-club member relationship to develop, the full 16-meeting sequence is recommended. But the time actually available at an afterschool may not allow this. At a minimum, do the first eight challenges and choose additional ones as time and budget permit. Generally speaking, try for as long a timeframe as possible. This will give the kids and mentors more opportunities to get to know one another, and let mentors share more details about what they do as STEM professionals (or students) and the paths that led them there.

Kids like clubs

Kids like being part of a group that meets on an ongoing basis and where hands-on activity and creative thinking are celebrated. Also, the supportive relationship that kids develop with a STEM mentor makes them feel that they have a meaningful connection to the professional world. The combination keeps kids coming back each week!



This guide makes it easy to launch a club, get kids excited about the invention process, and stimulate their interest in STEM.

Finding a STEM Mentor or an Afterschool Partner

A successful *Time to Invent* club is a partnership made up of kids, afterschool staff, and volunteer STEM mentors. Need to locate one of these partners? Read on.

Finding afterschool programs

Prospective mentors can start by contacting **local elementary schools**, which often run afterschool programs. Also, use the links below to find local chapters of these national organizations, all of which offer afterschool programs:

- Boys and Girls Clubs: bgca.org
- Boy Scouts: scouting.org
- Girls Inc.: girlsinc.org
- Girl Scouts: girlscouts.org
- YMCA: ymca.net
- 4H clubs: 4-H.org

Finding STEM professionals/students

Professional organizations. These organizations have members in every state and often have willing volunteers in your area. Afterschool staff can visit their Web sites and see if there is a local chapter to contact for volunteers.

- American Society of Civil Engineers: asce.org
- American Society of Mechanical Engineers: asme.org
- Biotechnology Industry Organization: bio.org/members
- The Institute of Electrical and Electronic Engineers, Inc.: ieee.org
- National Society of Black Engineers: nsbe.org
- Society for Hispanic Professional Engineers: shpe.org
- Society of Women Engineers: swe.org

More volunteering Web sites

To find afterschools looking for volunteers or volunteers looking for afterschools, visit Web sites, such as:

- dedicatedengineers.org
- idealist.org
- stemedcoalition.org
- volunteermatch.org

EWEEK. National Engineers Week offers a searchable database of volunteer engineers from around the country. For more information, go to the Engineering Contacts Directory at: eweeek.org/site/discover/eweeksrch.shtml.

Local science or engineering companies. Many companies encourage their employees to volunteer in local schools.

Science or children's museums. Many museums have partnerships with local scientific and engineering societies and may be able to connect you to STEM professionals. Contact your local museum's education department for more information.

Universities. Contact engineering and/or science departments and ask them about faculty and students who might be interested in volunteering in an afterschool engineering and invention club. Here are some tips for reaching interested faculty and students:

- Call a university's main line and ask to speak to the Dean's office of the science, technology, engineering, or math programs or to a professor in these areas. Ask if the office can recommend student volunteers or on-campus STEM societies to contact.
- Contact the public service department or student center to publicize your volunteering opportunity for interested students.

Local alumni associations. Contact alumni associations at universities and colleges in your area for STEM professionals interested in volunteering.

Key talking points when making the call

If you're with an afterschool program and are calling a potential mentor, or if you're a mentor contacting an afterschool site to see if they're interested in hosting a *Time to Invent* club, the talking points below will help you cover the key topics. (The caller is in bold below.)

Introduce yourself

- **Afterschools:** Introduce yourself and your organization.
- **Mentors:** Ask to speak to the afterschool director. Introduce yourself and state your affiliation (college or company).

Explain your intention

- **Afterschools:** Explain that you'd like to run an invention club for fifth graders at your afterschool and are looking for STEM professionals/students to volunteer and mentor the kids.
- **Mentors:** Explain that you want to lead an invention club for fifth graders at their afterschool site.

Emphasize that the mentor will be part of a team

- **Afterschools:** Mention that the mentor won't be solo. The mentor will have a second mentor as well as an afterschool staff member for support.
- **Mentors:** Mention that you won't be solo. You will have a co-mentor but will need an afterschool staff member to participate in the sessions to ensure the program's success.

Say you have a curriculum

- **Both:** Clarify that you have a tested curriculum that was developed by WGBH. Explain that the program focuses more on invention, hands-on problem solving, and the design process than on science concepts. Tell them that they can see the curriculum (and even download it) on the *Time to Invent* Web site (timetoinvent.org).

Describe the club

- **Both:** Mention that the club meets once a week for up to 16 weeks, is based around hands-on activities, has a modest materials cost (\$200–400 for the 16-week program), and is intended to keep kids engaged in STEM.

Describe your experience with kids

- **Afterschools:** Describe the kids in your program, including ages, interests, and abilities. Find out if the mentor has experience working with kids.
- **Mentors:** Describe your experience working with kids. Find out if the afterschool site has 6–12 fifth-grade kids that you could work with.

Define roles

- **Afterschools:** Explain that the mentors will be responsible for leading activities each week but will be assisted by an afterschool leader. (See page 5.)
- **Mentors:** Explain that you and your co-mentor will be responsible for leading activities each week, while afterschool leaders will be responsible for classroom management during the activities.
- **Both:** Offer to send the *Roles and Responsibilities* chart. (See page 5.)

Follow up

- **Afterschools:** Ask about the best way to contact the mentor. Let him or her know you'll follow up to finalize things (e.g., providing a copy of the curriculum, doing a background check, coordinating schedules, etc.). Invite the potential mentor to visit your program so you can introduce the mentor to the staff and kids and show him or her the facility.
- **Mentors:** Exchange contact information and let the afterschool leader know you'll follow up to confirm. Set a time and date for visiting the site to meet the staff and kids, see the facility, coordinate schedules, and show the program director the *Time to Invent* curriculum.

Roles and Responsibilities of the Mentors and Afterschool Leaders

Before the club starts, the mentors and afterschool leader should read the guide and meet at the afterschool site to go over roles, responsibilities, and expectations. Things to discuss include:

- scheduling the program sessions, taking into account the kids' schedules, other afterschool programs, and the mentors' work/school obligations.
- how the materials will be paid for. The full 16-week program runs \$200–400, depending on the supplies available at the afterschool. See the Master Materials List (page 14) for details.
- established ground rules and routines, such as eating in a room and a “stop & listen” signal.
- the acceptable energy level of kids during the club. An afterschool environment tends to be noisier than a school classroom. Ask how you can determine which levels are acceptable.
- a signal mentors can use to indicate that they need the afterschool leader's help.
- whether you will send weekly text/e-mail messages, and who will send them. (See page 175.)

Before the club starts...

Mentors/Co-Mentors

- Discuss how you will divide tasks with your co-mentor, such as buying materials and leading parts of the challenge.
- To prepare for a meeting, read the Leader Notes, especially the Get Ready Ahead of Time section.
- Purchase/gather the materials. Find out what materials are already on site.
- Do each challenge before doing it with kids.

Afterschool Leaders

- Recruit 6–12 fifth graders for the club.
- Communicate to families about the program's weekly commitment.
- Conduct background check on the mentors.
- Discuss with mentors what materials your program can provide and the process for borrowing materials.
- Gather any materials available on site.
- Establish a safe storage area on site for materials and projects. If storage is limited, talk with the mentor about a storage plan.

While the club is running...

Mentors/Co-Mentors

- Show up each week prepared to lead.
- Arrive at least 15 minutes early to set up.
- If sick or the unexpected arises, communicate absence to co-mentor and afterschool leader.
- Get feedback from afterschool leader on working with kids. Ask for help when needed.
- Save projects for the Meeting 8 and 16 celebrations. If there's ample storage space, save all the projects. Kids can take them home once the program ends.

Afterschool Leaders

- Assign an experienced staff member to attend each session to oversee classroom management and deal with kids who are being disruptive.
- Take photos of kids doing the challenges.
- Check in with mentors often to offer feedback on how to improve the sessions and to find ways to provide support.

Guide Components

Each meeting write-up—the **Leader Notes**—has features designed to help you quickly understand what kids will be doing and how you can run a fun, successful session that keeps kids coming back for more.

Leader Notes are your comprehensive guide to each club meeting.

The **Overview Box** provides a snapshot of the meeting.

Get Ready Ahead of Time offers specifics about preparing for the meeting.

Materials lists everything you'll need for the meeting. For tips on where to purchase the materials, see the Master Materials List (p. 14).

Meeting 3

HIT THE TARGET

Challenge
Invent a foot-activated ball launcher that can hit a target four feet away.

Client
A toy company, as described in Step 2

Agenda
1 Discuss the concept of a client.
2 Introduce the challenge.
3 Brainstorm design ideas for launchers.
4 Build, test, and redesign the launchers.
5 Share results and wrap up.

What success looks like today
Kids understand the client's role in the invention process, and they realize that they are using the design process as they build their launchers.

Get ready ahead of time

- Read these Leader Notes. To guide you as you run the session, make note about key points, questions to ask, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout and the *Inventing for a Client* handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

Materials

For the group	Per pair
<input type="checkbox"/> 3-4 rolls of duct tape	<input type="checkbox"/> 1 wooden spool
<input type="checkbox"/> ruler	<input type="checkbox"/> 1 paint stirrer
<input type="checkbox"/> pencils	<input type="checkbox"/> 1 Ping-Pong® ball
<input type="checkbox"/> paper (scrap paper is fine)	<input type="checkbox"/> 2 paper cups (3.5 oz)

The Design Process

The design process helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

31

Kids invent a variety of launcher designs—catapults, seesaw-like designs, and even ones made by directly attaching a paint stirrer to a shoe.

DESIGN PROCESS STEP

Build, test, and redesign (20 minutes)

Divide the group into pairs. Distribute the *Hit the Target* handout and materials. Circulate around the room and help teams troubleshoot issues that come up by asking questions. For example:

If the ball flies too far or not far enough, ask...
How do you change the force of a lever? Have kids experiment with the position of the fulcrum and figure out how to control the force on the ball. Eventually, they'll find a position that gets the ball to go where they want it to go.

If the launcher is inaccurate, ask...
What's the main reason your launcher is inaccurate? If the ball is in a different place every time, have kids make a holder for the ball to sit in. If the launcher shifts after every shot, mark the position of the parts so that when things shift, kids can set up the launcher the same way again.

Adjust the challenge level

Easier: Have kids start with a seesaw-like arrangement, with the spool under the middle of the paint stirrer.

More Difficult: Design a launcher that can hit a target 16 feet away.

The **Procedure** provides step-by-step instructions for running a meeting. It is organized using the steps of the design process—brainstorm, design, build, test, redesign, and share. This section identifies issues that might surface during a challenge and suggests strategies you can use with kids who face them. There are also talking points and discussion questions.

Adjust the Challenge Level suggests ways to modify the level of difficulty of the challenge in order to accommodate kids of different abilities.

The **Handout** (available in English and Spanish) steps kids through a challenge.

The **Overview** introduces the challenge and the client that kids are designing for.

TIME TO INVENT CLUB

HIT THE TARGET

A popular toy company is looking for a fun way to sharpen kids' coordination and keep them active. The big toy convention is coming up, but all the engineers at the company are busy with other projects. The head of the company is turning to you to invent a solution.

Materials

- duct tape
- 1 paint stirrer
- 2 paper cups (3.5 ounces)
- 1 wooden spool
- 1 Ping-Pong® ball

Challenge

Your client wants you to invent a toy that can launch a ball and hit a target that's four feet away, using only a person's feet!

1 Brainstorm and Design

- How can you use these materials to build a ball launcher?
- How can you use your foot to launch a ball and hit a target that's four feet away?
- What kind of holder will keep the ball on the launching platform?

2 Build, Test, and Redesign

Set the ball in place. Launch! Bull's-eye? If not, ask yourself these questions and revise your design:

- **Your ball goes too far or not far enough.**
How does the position of the spool affect how much foot power gets through? Is the problem with the spool or with the paint stirrer?
- **Launcher is inaccurate.**
Can you identify the main reason your launcher is inaccurate? Is the ball in a different place every time? Does the launcher shift after every shot?

3 Invent Some More

- Design a launcher that can hit a target six feet away!
- Launch a ball straight up so you can catch it with your hands.

KEEP INVENTING

invent today
Build a rubber band-powered racecar, hidden alarm, or confetti launcher. Find these projects and dozens more at: pbs.org/designsquad.

invent this week
Invent a game or toy and enter it in a contest, such as TOYchallenge® or BKFC. Find out more at: sallyrides/science.com/toychallenge and at: bkfc.com.

TIME TO INVENT is funded by the **Lemelson Foundation** Improving lives through invention. **WGBH** PBS.org

The **Invent Some More** section offers extension ideas for kids who finish the basic challenge early or who want to continue working on the challenge outside the club time.

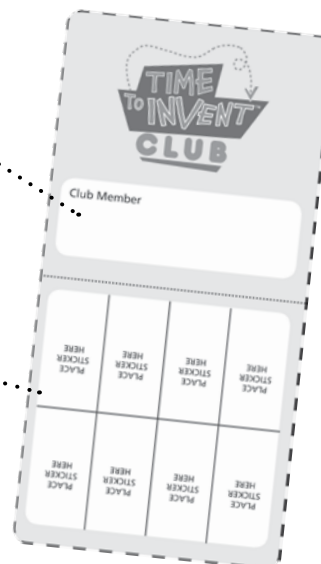
The **Keep Inventing** box suggests practical ways for kids to keep their inventive energies going between meetings and after the club ends.

The **Procedure** follows the steps of the design process—brainstorm, design, build, test, and redesign.

Membership cards add to kids' sense of belonging and identify them as club members.

Nametag: The membership card doubles as a nametag. Hand out the cards at the start of each meeting and collect them again at the end so they don't get lost in between meetings.

Stickers: Kids get a sticker for each meeting they attend and adhere it to the appropriate box on the back of the card.



Invention and the Design Process

Inventors improve the world by developing solutions to people's problems. The steps they use to arrive at a solution are called the **design process**. Having kids learn the design process is a goal of the *Time to Invent* program. As kids work through a challenge, use the questions below to tie their work to specific steps of the design process.

Define the problem

- What does the client want?
- How can we improve this situation?

Brainstorm

- What are some different ways to tackle today's challenge?
- Off-the-wall suggestions often spark GREAT ideas. How creative can you be?

Design

- Which brainstormed ideas are really possible, given your time, tools, and materials?
- What are some problems you need to solve as you build your project?
- How can a sketch help clarify your design?

Build

- What materials will you need?
- What can you learn by looking at other kids' projects?

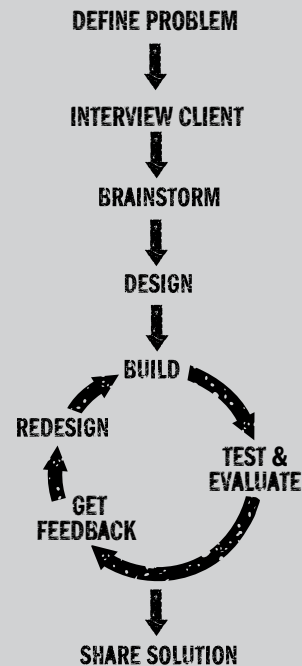
Test, evaluate, and redesign

- Why is it a good idea to keep testing a design?
- What things do you need to tweak to get it to work?
- What specific goal are you trying to achieve, and how will you know if you've achieved it?
- How well does the design meet the challenge's criteria or the client's needs?

Share solutions

- What's the best feature of your design? Why?
- What was the hardest problem to solve?
- If you had more time, how would you improve your project?
- What other clients might be interested in what you invented?

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Visuals help kids understand things better. Draw this graphic on the board or post the Design Process poster. (See below.)

Teaching kids the design process

The design process is built into each challenge. As kids work through a challenge, they'll see that the design process encourages creative problem solving. Since visuals are powerful learning tools, either draw the Design Process graphic on the board or print out and post the Design Process poster, found at: pbs.org/designsquad/parentseducators/printable_resources.html.

Talking with Kids about Invention

Who me? An inventor?

Yes! The key to inventing is recognizing a need and devising an original solution. Let kids know that we all solve problems through inventive thinking, whether it's figuring out a way to prop open a window, stay dry in a rainstorm, or build a playhouse from scrap materials. Creative problem solving, improvisation, flexibility, and tinkering—all parts of the *Time to Invent* club experience—drive the inventive spirit.

What's an invention?

Let kids know that an invention is a useful creation that didn't exist before.

- An invention usually fills a need or solves a problem.
- Inventions often make the world a better place.
- Inventions can be things (e.g., a cell phone or backpack) as well as ideas (e.g., a story, phone app, or a new method for tying a knot).
- An invention often makes something faster, stronger, cheaper, easier, safer; or more efficient, attractive, useful, accurate, fun, or productive.

Why invent?

- **To solve problems.** Inventors are skilled at finding ways to improve a situation or process.
- **To improve our world.** Inventions can improve things at home, at school, in the community, and in the world. Imagine how different our lives would be without inventions like computers, refrigerators, electricity, plastic, and medicine.
- **To engage in the creative process.** When kids create their own solutions, they get excited about the process of inventing.
- **To have a fulfilling career.** Inventors use science and engineering to improve things in areas, such as health, housing, food, safety, transportation, aerospace, electronics, entertainment, communication, and the environment.

Inventing is solving problems for clients

In the *Time to Invent* club, kids learn that the fun of inventing is coming up with creative solutions for clients. In some meetings, the clients are the kids themselves. In others, it's someone they read about. And sometimes, it's the kids down the hall. By the time your kids complete the club, they'll know that inventors:

- interview the client to learn about his, her, or their specific needs
- design and build solutions that address the client's needs
- get client feedback to make sure that the solution is on target

Tips for Leading Open-Ended Challenges

Before every meeting

- **Read the Get Ready Ahead of Time section.** This will help you start the meeting right away and reduce the chances of kids getting involved in off-task behavior.
- **Do the activity yourself.** This lets you anticipate where kids might need help and how to modify materials or instructions to fit your situation.
- **Have extension ideas ready.** The Adjust the Challenge Level sidebar in the leader notes and the Invent Some More section on the kids' handout provide suggestions for kids who finish early or need an additional challenge.

During the meeting

- **Engage kids.** Ask a question that gets kids talking about their own inventing.
- **Clarify the problem.** Understanding a problem is key to finding solutions. Encourage kids to rephrase the problem in their own words to be sure they understand.
- **Brainstorm design ideas.** Consider different ways to tackle the challenge.
- **Wait to distribute materials.** Let kids get the materials once you're ready to have them start building. Otherwise they'll be distracted and likely to miss important directions.
- **Ask rather than tell.** As kids build and test, ask leading questions rather than telling them what to do. For example, ask: "Why do you think this is happening?" or "What would happen if...?" or "What is another thing you could try?"
- **Help kids get back on track.** When kids are stuck, remind them that problems are opportunities for creative thinking. Ask them to come up with several possible ways of solving their problem. Also, encourage kids to look at other kids' designs.
- **Channel kids' energy.** Engage a restless kid by giving him or her a specific job to do, like organizing or handing out materials. Also, adjust the level of the challenge if you sense that kids are bored with a challenge that's too easy or are finding it too hard.
- **5-minute warning.** Give kids a heads-up about when the building needs to stop and the Wrap Up needs to start.

Wrap up

- **Reinforce key *Time to Invent* messages.** It's often tempting to skip a wrap-up section. But in *Time to Invent*, the Wrap Up is crucial. This is when kids present their work and talk about creative thinking, the design process, and solving problems. They also hear about related real-world examples, what engineers do, and how creative problem solving and STEM are relevant beyond the school's walls. In short, the Wrap Up is the time to reinforce key *Time to Invent* messages.
- **Move!** Don't do the Wrap Up with kids sitting at the tables where they've been building. To get kids to stop building and focus their attention on discussing their work, gather the group in a different part of the room, even if it means sitting in a circle on the floor.
- **Keep Kids Inventing.** There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Alert kids to the opportunities listed in the Keep Inventing section.



The Wrap Up is your chance to reinforce key Time to Invent messages.

Effective Mentoring

An effective mentor is someone who wants to make a difference and who is committed to helping kids have a positive experience. You are in a unique position to open doors for kids who may not have STEM role models in their lives. You'll have an impact by encouraging inventive thinking, modeling the design process, discussing science and engineering concepts, and sharing stories about what you do and how you got there.

Tips for being an effective mentor

- **Know the group.** Work with the afterschool leader to learn about the dynamics of the group you're mentoring. Don't hesitate to ask the afterschool leader for help.
- **Focus on the relationship.** In any mentoring situation, the most important thing is building a relationship based on trust, respect, and consideration. Kids will respond positively to any support and gentle guidance you offer.
- **Show up.** Commitment and consistency are important to building trust.
- **Listen.** Spend more time listening than talking. Giving kids your full attention shows that you care about and respect them.
- **Set a positive tone.** Help kids see that the challenges are not competitions but rather are opportunities to unleash their own ingenuity and creativity and to collaborate with others.
- **Be real.** Mentoring is about building relationships, and kids will respond positively when they feel they have a connection with you. Tell kids about yourself at their age and how your interest in engineering/science/inventing developed. Share your enthusiasm and show your passion for inventing—it will be contagious.
- **Be patient.** Remember that you're working with fifth graders, many of whom are inventing and applying STEM concepts for the first time.
- **Avoid being judgmental.** Praise or criticize behaviors rather than individuals. For example, you could say, "I'd appreciate it if you raised your hand when you have something to say."
- **With kids, attitude is everything.** Have a sense of humor, show respect, and maintain high expectations for the kids. You'll be approachable and appreciated!
- **Involve families.** The support of family members is a significant factor in keeping kids involved in STEM. After each meeting, send families a text or e-mail message (pages 175–179). They will serve as conversation starters, helping families talk with their club member about what he or she did that day.

Expand your skills

New to leading hands-on challenges? You can build your skills and confidence in guiding kids through hands-on invention and engineering activities by doing this free, self-guided NASA-*Design Squad* Online Workshop. You'll see how to use the design process with kids, learn a host of strategies for facilitating open-ended challenges, and experience the fun and relevance of engineering. Find the training at: pbskidsgo.org/designsquadnation/parentseducators.



What success looks like in a *Time to Invent* club

By leading club members through the challenges in this guide, your bottom-line goal is for kids to:

- learn how to use the design process to come up with creative solutions to problems
- understand what inventing is all about
- see science, technology, engineering, and math as exciting pathways for their own lives



As a mentor, you are in a unique position to open doors for kids who may not have STEM role models in their lives.

Master Materials List

This page summarizes the materials used in the *Time to Invent* club. For items and quantities needed for each meeting, refer to the meeting's Leader Notes. To reduce costs, speak with the afterschool leader to see what is already available at the afterschool program before you purchase anything. Note that Meetings 8 and 16 are celebrations that include optional invention challenges, for which the materials required depend on which activities you choose. Speak with your afterschool leader about the best way to collect the plates, cups, refreshments, and anything else you might need for these celebrations.

NOTE: Items marked with * have important notes at the end of the Materials List.

Where to get it	Material	Meeting(s)	Total Quantity Needed for 12 Kids for all Meetings	Suggested Total Cost
Collect from Afterschool Site (if possible)	Books	2, 4	16–24, depending on thickness	N/A
	Clear tape	1, 4, 9, 11, 12, 13, 16	6 rolls	N/A or \$10
	Copier or scrap paper	ALL	As needed	N/A
	Hole punchers	11, 13	4	N/A or \$10
	Markers	1, 5, 6, 11, 13	2 packages	N/A
	Paper towels	1	1 roll or pile of sheets	N/A
	Pencils	ALL	12	N/A
	Rulers	1, 2, 3, 4, 5, 6, 16	2	N/A
	Scissors	ALL	6 pairs	N/A or \$6–10
Collect for Free	Large cardboard boxes*	5, 6	24	N/A
	Newspaper	1, 8, 9, 12	50 sheets	N/A
	Pennies (exchange bills at bank)	4	6 rolls (50 pennies per roll)	N/A
	Scrap cardboard pieces	4, 7, 8, 14, 15, 16	24	N/A
	Box tops	11, 13	12	N/A
Grocery/Dollar Store	Aluminum baking tins, 8½ x 11 x 1"	11	6	\$6
	Aluminum foil	7, 11, 13	2 rolls	\$6
	Balloons, 9" or larger	14, 15	10	\$2
	Batteries, 9-volt* (non-alkaline)	7, 13	6	\$3
	Clothesline	5, 6	50 feet	\$2
	Fruit roll-ups	1	12	\$3
	Mini rice cakes*	9	2 packages	\$6
	Paper cups, large 12 oz	1, 13, 14, 15	Pack of 50	\$3–4
	Paper cups, small 3.5 oz	3, 10	24	\$2
	Paper plates	14, 15	20	\$2
	Plastic wrap	9, 11	4	\$6
	Small bottle of bubbles with wand*	1	6	\$6
	Straws, flexible	1, 2, 9, 10, 11, 13	4 boxes of 100	\$5
	Supplies and snacks for celebrations	8, 16	TBD	TBD
	Thin string	4, 7, 9, 10, 11, 14, 15	5 spools	\$10

Master Materials List continued

Where to get it	Material	Meeting(s)	Total Quantity Needed for 12 Kids for all Meetings	Suggested Total Cost
Hardware Store	Duct tape*	ALL	6 rolls +	\$40
	Electrical tape	7, 13	6 rolls	\$6
	Hex nuts	11	60	\$5
	Paint stirrers	3, 14, 15	26	\$3
	Retractable utility knife (box cutter)	5, 6, 11	2 (for leaders only)	\$5–10
Office Supply	Brass fasteners (3/4" or larger)	11, 13	2 boxes	\$3
	Chipboard 8½ x 11"	7, 11	12	\$7
	Cardstock	10, 13	1 package	\$8
	Index cards	1, 4, 9, 11, 13	1 pack of 500	\$4
	Lanyards for nametags	ALL	12	\$7–9
	Manila envelopes, 8½ x 11" unpadded*	9	12	\$6
	Masking tape	1, 2, 4, 8, 12	3 rolls	\$5
	Paper clips (large)	1, 7, 9, 11, 13	2 boxes	\$3
	Rubber bands	9, 10, 11, 13, 14, 15	2 bags	\$4
	Small stickers	ALL	200	\$3
Electronics Store	Batteries, 9-volt*	7, 13	6	\$3
	Battery snap-cap connectors	7, 13	6	\$4
	Buzzers	7, 13	6	\$21
	Electrical hook-up wire (stranded 22-gauge; 75')	7, 13	3 rolls	\$20
	Wire strippers	7, 13	3	\$9–16
Sports/Party/Variety	Beach balls	14, 15	2	\$4
	Marbles*	11, 13	12	\$3
	Ping-Pong® balls	3, 10, 13, 14, 15	1 package of 12	\$3
	Swimming noodles*	14, 15	2–3	\$5–7.50
	Tennis balls	2, 7, 13	2 cans (6)	\$8
Craft Store	Craft sticks	10	1 package	\$2
	Magnets*	7	12	\$4
	Pipe cleaners	9, 10, 14, 15	1 package	\$2–3
	Wooden spools*	3	6	\$3

- Cardboard boxes: If you can't find these, you can buy 2 x 3-foot (larger is OK, too) sheets of cardboard at office supply stores (36–60 sheets for \$25–50).
- Rice cakes: Meeting 9's optional extension activity uses regular size (versus mini) rice cakes.
- Bubbles: Only necessary if doing Meeting 1's Bubble Challenge.
- Duct tape: For low prices, try surplustape.com or uline.com.
- Manila envelopes: You'll need around \$15 for postage to mail kids' envelopes in Meeting 9.
- Batteries: Buzzers work best with 9-volt batteries and snap-cap connectors. Non-alkaline ones cost about 50 cents each and are found at dollar stores and online. (Search online for non-alkaline 9-volt batteries.) If inexpensive 9-volt batteries are unavailable,

kids can use expensive 9-volt batteries or AA batteries and battery holders (available at electronics stores).

- Marbles can be found at dollar, toy, and flower stores.
- Swimming noodles are seasonally available. Call ahead.
- Magnets come in a variety of shapes and sizes. The 3/4-inch diameter discs suggested in Meeting 7 come in packages of 8. (NOTE: Any magnet a 1/2-inch in diameter and up will work.) Magnetic sheets (used for magnetic car decals and magnetic ads) can be cut with scissors into 1-inch squares. Magnets and sheets are sold in office supply, craft, and hardware stores.
- Wooden spools: If you can't find them, you can use large spools of thread (no need to remove the thread).

CLUB LAUNCH AND WELCOME

Overview

Welcome everyone, introduce the club, and do some quick invention challenges that will leave kids eager for more.

Agenda

- 1 Welcome everyone and play a name game.
- 2 Explain how the club works.
- 3 Choose two or three invention challenges to do with kids.
- 4 Wrap up.

What success looks like today

Kids get excited about doing invention challenges and look forward to next week's meeting.

Get ready ahead of time

- Read these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Choose two or three invention challenges to do with kids. Step 3 lists the four options.
- Bring a camera for taking photos of kids doing the challenges.
- Purchase materials and photocopy membership cards in color, if possible. (You'll find the membership card master in the back pocket of the binder.)

Materials

- ☐ The materials you need depend on which invention challenges you choose. The materials are listed with each challenge in Step 3.
- ☐ Lanyards with vinyl nametag holders, membership cards, stickers, markers



Today is about fun and engagement and about getting kids excited to do more invention challenges at next week's meeting.

1 Welcome (10 minutes)

Kick things off with the afterschool leader

Of course, kids already know the afterschool leader. But they need to understand that the *Time to Invent* club is connected to the afterschool program and that he or she will play an active role in the club. The afterschool leader should describe his or her role. Several of the role's key features are listed below. For more details about roles, see page 5.

- Help kids have fun as they invent stuff.
- Assist kids in tackling the *Time to Invent* challenges.
- Oversee classroom management.
- Communicate with families about the *Time to Invent* club.
- Take photos of kids doing the *Time to Invent* challenges.

Introduce the mentors

Reinforce the *Time to Invent*–afterschool connection by having the afterschool leader introduce you and your co-mentor. You and your co-mentor should tell the kids about your jobs (or what you're studying) and briefly say what you like best about what you do (e.g., doing something you love, getting to think up new designs, making a difference through what you do, etc.).

Play a name game

Have the kids help you learn their names and build a connection with you. Hand out the membership cards and markers. Have each kid write his or her first name neatly on the card and return it to you.

- 1 Go around the circle. Ask each kid to say his or her first name, plus one of the following:
 - One word that describes something about him or her, or
 - One food or animal whose name begins with the same letter as the kid's first name.
- 2 Ask the next person to repeat the name(s) and descriptor(s) of each kid who's gone before and then to say his or her own name, plus a "reminder" word. Make sure each mentor and the afterschool leader participate, saying their names and adding a descriptor.
- 3 Once every kid has had a turn, it's your turn to go around the circle and repeat everyone's name. (You and your co-mentor can work together.) And don't worry if you mess up. The kids will love you for trying.
- 4 Finally, hand out the correct nametag and a vinyl nametag holder to each kid. Have kids slip the nametags into the holders.

② Introduce the club (10 minutes)

Introduce invention

Start by asking kids what they think inventors do. Then sum up by explaining that inventors improve people's lives by making things that are useful.

Tell kids how the club works

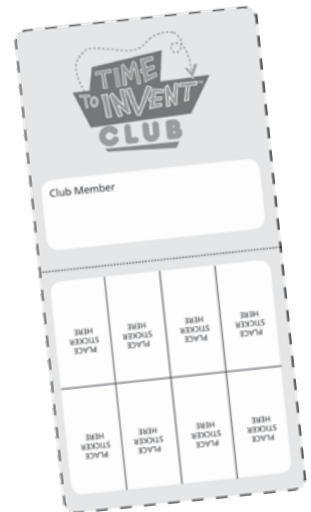
- *Time to Invent* is an invention club. It meets every week on the same day, at the same time, and in the same place.
- During the club meetings, we're going to tackle interesting challenges, work together to come up with creative solutions, and invent things to solve the challenge.
- For each meeting you attend, you'll get a sticker to put on the back of your membership card.
- The last meeting is a party where you'll show your inventions to other kids in the afterschool program and to any family members who can attend.

Getting your *Time to Invent* club started

See page 10 for tips on leading open-ended challenges and page 12 for tips on effective mentoring.

Ground rules

- Arrive on time, ready to invent.
- Follow the rules of the afterschool program—acceptable behavior, eating, respect for materials and each other, etc. Have the afterschool leader tell kids what the club's "quiet-down" signal will be (e.g., flashing the lights), either the program's existing signal or one you establish.
- Be respectful of everyone's ideas. Some of the wildest ideas lead to interesting—and effective—solutions! (Take this opportunity to have the afterschool leader remind kids to show the co-mentors the same respect they do for the afterschool staff.)



③ Do 2–3 quick invention challenges (25 minutes)

Below are four invention challenges. In addition to being just plain fun, these icebreakers will spark kids' inventive spirits, help build a sense of community, and let kids experience success. Doing all the activities will take more time than you have. Plan on doing two to three challenges.

Start with *Treat on the Wall* (a BIG hit with kids!). Then choose one or two others. (You may have time to do only one of these, but it's best to be prepared.) In general, keep things moving—your first day is about fun, variety, and engagement! Set time limits and stick to them to keep the momentum going and to avoid having teams overwork an idea. Remember, you want kids to leave today's meeting excited about doing invention challenges and eager to return next week.

Treat on the wall (10–15 minutes)

Materials (per pair): 2 fruit roll-ups—one for the wall and one to hand out to the partner, roll of masking or clear tape, 2 sheets of newspaper, 5 paper clips, 1 medium-sized (e.g., 12 ounce) paper cup

Necessity is the mother of invention, as the saying goes. When a tasty treat is involved, kids will work extra hard to come up with inventive ways to get it!

- Before kids enter the room, tape to the wall one fruit roll-up per pair of kids, several feet out of their reach (i.e., seven to eight feet up). Tape the roll-ups so that kids need to apply moderate pressure to knock them down. If you tape them too lightly, there's no challenge. If you tape them too securely, it's too difficult!
- Kick off the challenge by asking kids to look around the room and point out anything unusual they see.
- Tell them the challenge: Invent a device to get the treat down. They must stand on the floor and cannot grab the treat with their hands. If they get it down, they can have it. (Ask the afterschool leader if there are any allergies or rules about eating in the room.)
- Have extra roll-ups on hand so that each partner can have his or her own treat.



Necessity is the mother of invention. Kids invent ways to snag a treat that's been taped to the wall.

Bubble challenges (10 minutes)

Materials (per pair): Small bottle of bubble solution with bubble wand included, 3 straws, 3 index cards, paper towels for cleanup

Inventions often start when people think “outside the box.” Treating soap bubbles tenderly is a little out of the ordinary and can help promote inventive thinking. Do one, two, or all three of the bubble challenges described below.

Challenge 1: Invent ways for a bubble to travel across the room without popping. (There are two versions of this challenge. In version 1, making contact with the bubble is OK. In version 2, making contact with the bubble is NOT OK. You can offer kids one or both versions.)

Challenge 2: Invent ways to keep a bubble from hitting the ground, without touching it with their hands or with any other object.



Kids invent ways to move soap bubbles without popping them.

Paper clip challenge (10 minutes)

Materials: 3 large paper clips per kid, 1 large (e.g., 12 ounce) paper cup, watch or clock, ruler

Inventing often means imagining new uses for existing items. This challenge asks kids to re-envision a paper clip as a piece of wire that can be reshaped and used in a new way.

- Divide the group in half, forming two teams.
- Tell them the challenge: Make the longest paper-clip chain possible in two minutes.
- Start by giving the groups two minutes to brainstorm ideas—emphasize that giving everyone a turn to speak and listening carefully are two keys to a successful brainstorm.
- After the brainstorm, give each kid a paper clip. Give teams two minutes to fashion their chains. If a paper clip breaks, provide a new one.
- After two minutes, have each team hold up its chain. Compare lengths.
- It's likely that kids will have bent open their paper clips, making them much longer than the original. Congratulate both teams on their ability to re-imagine a paper clip as a piece of wire. Since thinking outside the box was the real challenge, both teams won!
- Tell kids that inventing often means imagining new uses for existing items. Emphasize this point by holding up a paper cup. Challenge kids to see how many different ways they can think of using a paper cup (e.g., a vase, stand for an art project, party hat, hearing aid, megaphone, target for a game with a ball, pencil holder, fire starter, etc.).



Inventing often means imagining new uses for existing items. Kids reshape paper clips to make the longest chain possible.

#hands-on ball challenge (10 minutes)

Materials: 1 ball, basketball size (get one from the afterschool), clock or watch

People are constrained by the assumptions they make—different assumptions about what's OK can lead to different outcomes and behaviors. This challenge underscores the importance of questioning assumptions and thinking outside the box.

- Have kids sit in a semicircle. Explain the challenge exactly like this: “See how quickly we can get everyone to touch the ball.”
- Without saying more, quickly hand the ball to the kid on the end and start timing. Starting things off this way implies that you want kids to pass the ball down the line.
- The game ends when everyone has touched the ball. Note how long it took.

- The phrasing of the challenge is open to interpretation—it sets no limits on how the ball is passed or even whether it’s passed at all! To explore kids’ assumptions, play 20 Questions. Tell them that the new goal is to beat Round 1’s time. Have each kid ask you a Yes-No question about what they’re allowed to do. Let kids “pass” if they don’t have a question. Answer only yes or no.
- Hand the ball to one of the kids and start timing. The questioning session should have enabled the group to improve the time.



Questioning assumptions helps inventors think “outside the box.”

The fastest solution is for everyone to touch the ball at once. If kids haven’t realized that this is allowed, point out their assumption: that everyone must have a turn. Discuss how assumptions (e.g., we need to be in a circle; we need to pass the ball; only one kid can touch the ball at a time; etc.) affected what happened. Questioning assumptions helps inventors think “outside the box.”

4 **Wrap up** (5 minutes)

It’s often tempting to skip a wrap-up section. But in *Time to Invent*, the Wrap Up is crucial. This is when kids will present their work and talk about creative thinking, the design process, and solving problems. They will also hear about related real-world examples, what engineers do, and how creative problem solving and STEM are relevant beyond the school’s walls. In short, the Wrap Up is the place to reinforce key *Time to Invent* messages.

- Gather the group. Go around and have each kid describe his or her best and worst moments. Let kids pass if they want. The co-mentors and the afterschool leader should also share their highs and lows.
- Compliment kids on successfully completing their first invention challenges. Let them know that they did a great job and that you’re glad to be there and are looking forward to seeing them back next week.
- Remind them that the *Time to Invent* club is a weekly commitment.
- Hand out a sticker for kids to put on their membership cards.
- Collect the lanyards, and tell kids they’ll get them back next week. Let kids know that at the next meeting they’ll invent something for the mayor!
- (Optional) Send families this week’s text or e-mail message. See page 175.

TROPHY TOWER

Challenge

Design and build a tower that's at least eight inches tall and can hold a tennis ball.

Client

The mayor's office, as described in Step 2

Agenda

- 1 Identify the key features of an effective support system by making a human tower.
- 2 Introduce the challenge and briefly describe what a client is.
- 3 Brainstorm ideas for designing a weight-bearing "trophy tower" made of straws and tape.
- 4 Build, test, and redesign the trophy towers.
- 5 Review how kids used the design process as they built their trophy towers.

What success looks like today

Kids see that in a structure (e.g., a tower), the parts work together to support a load. They also become familiar with the steps of the design process.

Get ready ahead of time

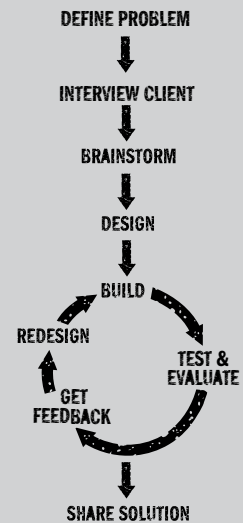
- Read these Leader Notes. To guide you as you run the session, make notes about key points, questions to ask, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout, one per kid.
- Draw the Design Process steps on the board or on a large sheet of paper.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

Materials

Per pair

- ☐ 20 flexible straws
- ☐ 1 tennis ball
- ☐ scissors
- ☐ masking tape, cut into three 12-inch lengths
- ☐ 1 ruler (shared by full group)

The Design Process

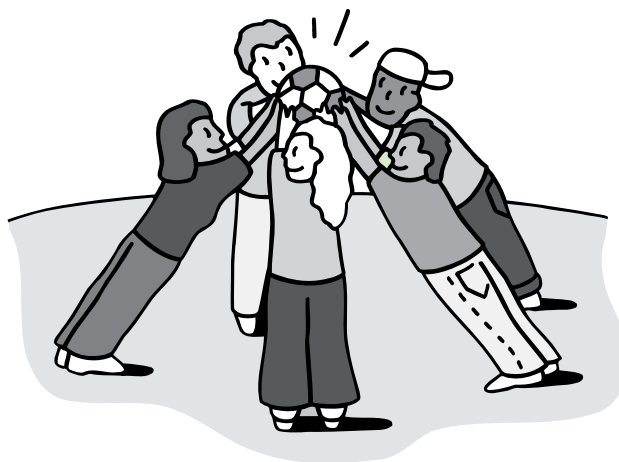


The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

① Form a human tower (10 minutes)

Use this team-building activity to get kids working together and thinking about structures.

- **One support.** Have a volunteer stand up and hold a heavy book above his or her head. Ask: How is the weight being supported? (*It's supported by a vertical support system—the skeleton.*) What kinds of structures support weight in the same way? (*Streetlights, road signs, parking meters, poles, etc.*)
- **Two supports.** Have a second volunteer come forward. Ask the two kids to hold the book between them, high above their heads. How is the weight being supported now? (*The weight is shared, with each person providing some support.*) What kinds of structures support weight in the same way? (*Arches, roofs, bridges, furniture, etc.*)
- **Two supports are not enough.** Gently push the book forward, between the two kids. Ask: Where should we add some more support to make this human structure sturdier? *Add front and back supports so the book will be supported in four directions.*
- **Four supports.** Have two more kids step up and provide two additional supports. Try to move the book. Point out that the four supports do two important things: resist both side-to-side motions and gravity's pull. Also note how the stable base helps anchor the book firmly in place. Ask: What kinds of structures use a series of connected supports to hold something up? *Roofs, swing sets, jungle gyms, buildings, bridges, towers, picnic tables, etc.*
- **Solid base and ample support.** Summarize the key features of an effective support system: a stable base and a system of supports that resists force in all directions.



DESIGN PROCESS STEP

② Define the challenge (5 minutes)

Engage the group

Ask: Who's ever built a structure, like a fort made out of cushions or helped build a real structure like a dog house or shed?

Have a few kids describe structures they've made. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge and the concept of “client”

(NOTE: Kids consider the concept of a client in detail in Meeting 3.)

CONGRATULATIONS! As the winner of the Citywide Tennis Championship, your school gets to take home the trophy. To honor your school, the mayor wants to display the winning ball at City Hall. Last year, the championship ball rolled off the

shelf and got lost. So this year he wants a stand to hold the ball. He's heard that the *Time to Invent* club can do the job. The mayor is your client, and he's hiring you! So here is your challenge: Using just straws and tape, design and build a tower that will hold a tennis ball at least eight inches off the ground.

DESIGN PROCESS STEP

③ Brainstorm and design (30 minutes)

Tell kids that brainstorming is a design process step that inventors and engineers use to come up with lots of possible solutions to a challenge. Remind them that they brainstormed ideas during activities in their first meeting. Explain that in a brainstorm, all ideas are welcome—often, off-the-wall suggestions spark GREAT thinking. Ask:

- What kinds of things do you need to think about as you design your tower?
Make sure the tower has a solid base, that the straws resist force in all directions, and that the straws are securely fastened together.
- What are some ways to use the straws?
Tape them together. Insert one lengthwise into the opening of another. Kids can also bend and tape them to make different shapes.
- Think of shapes that you see in things like furniture, towers, playground equipment, and buildings. What shapes help make structures strong? Why?
Triangles, rectangles, domes, cylinders, and arches. They distribute weight to the different parts of the structure's frame and then to the ground.
- How can you make a wobbly tower more stable?
Arrange the parts so they resist the forces on the tower. Also, widening the base can help keep a tower stable.

Adjust the challenge level

Easier: Make the minimum tower height six inches. Also, let kids tape the base to the table.

More Difficult: Make the minimum tower height ten inches. Reduce the amount of tape kids can use. Limit the number of straws to 15.

4 Build, test, and redesign (20 minutes)

Divide the group into pairs. (Ask the afterschool staff for help if tensions occur.) Distribute the handout and materials. Help kids if the following challenges come up:

If the tower tips over, ask...

Why do you think it's tipping over? Help kids pinpoint trouble spots. Also, make sure the base is wide enough. As a last resort, let kids tape the base to the table.

If the straws bend or collapse, ask...

Where do you need to reinforce the tower so it can support the ball's weight? Have kids try to spread the weight as evenly as possible, so all parts of the tower help hold up the ball.



Kids use the design process to build a tall tower strong enough to support a tennis ball.

5 Wrap up (15 minutes)

Reinforce key *Time to Invent* messages

Tell kids that today they used the design process when making their trophy towers. Draw the Design Process steps on the board or on a large sheet of paper. Tell them that the **design process** is a set of steps that people use to arrive at a solution. Inventors and engineers use it all the time, and so do you! You use the design process when you figure out solutions to certain kinds of problems. The steps are: Identify the problem, brainstorm solutions, decide on a design, build a solution, test it, revise the idea based on what you learn in testing, and share your final product.

- Let's look at an everyday example. Each morning you get dressed for the day. What might each design process step look like as you choose an outfit to wear? Brainstorm? (*Come up with different combinations of clothes*) Design and build? (*Select an outfit and put it together*) Test? (*See how it looks*) Redesign? (*Change something that doesn't look quite right*) Share? (*Wear the outfit in public*)
- What did the design process steps look like as you made your trophy tower? Brainstorm? (*Come up with tower ideas*) Design and build? (*Pick one idea and make the tower*) Test? (*See how well it works*) Redesign? (*Improve the design based on testing results*) Share? (*Present the tower to the client—the mayor*)

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the towers and lanyards.
- Let kids know that next week they'll invent something to sharpen their athletic abilities.
- (Optional) Send families this week's text or e-mail message. See page 176.

KEEP KIDS INVENTING

There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

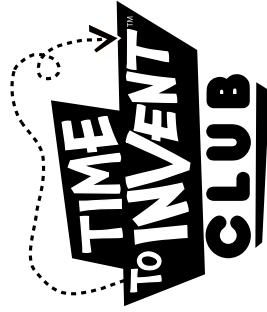
Invent today

Encourage kids to watch a *Design Squad™ Nation* episode on TV or online at: pbskidsgo.org/designsquadnation.

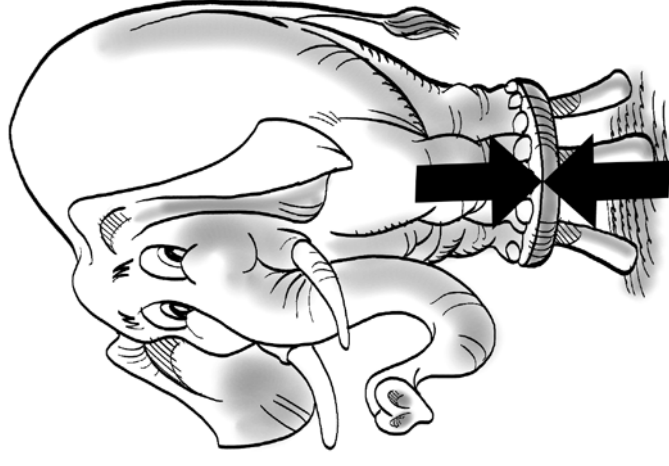
Invent this week

Encourage kids to ask an adult to take them to a science museum. They can check their library for free passes.

DESIGNsquad
Nation



Trophy Tower



CONGRATULATIONS! Your school won the city tennis championship. To honor your school, the mayor wants to display the winning ball at City Hall. But the ball needs to sit on top of a trophy!

Challenge

Your client wants you to design and build a tower that will hold a tennis ball at least eight inches off the ground.

1 Brainstorm and Design

- How can you use straws to make a tower strong enough to hold up a tennis ball?
- How will the tennis ball stay on top of the tower without falling off?
- How will you keep the tower from tipping over? (Taping to the table is not allowed!)

2 Build, Test, and Redesign

Put the tennis ball on top of your tower. Does it hold the ball? If not, ask yourself these questions and revise your design.

- **The tower tips over.**
Look at the tower from several directions. Does it lean? If so, redesign it so it stands straighter. Is the base wide enough? A narrow base can be tippy.
- **Straws are bending.**
What's causing them to buckle? Strengthen the straws or add supports so that all parts of the tower help hold up the ball.

Materials

- 20 straws
- 1 tennis ball
- masking tape (three 12-inch lengths)
- scissors
- ruler

3 Invent Some More

- Make a tower that can hold two tennis balls.
- Design a 16-inch tower that can hold a tennis ball.

KEEP INVENTING

Invent today

Watch a *Design Squad™* Nation episode on TV or online at: pbskids.org/designsquadradiation.

Invent this week

Ask an adult to take you to a science museum. Check your library for free passes.

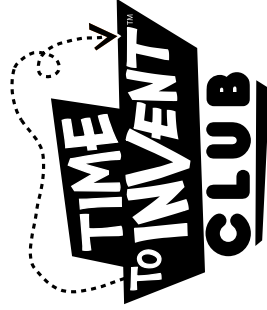


TIME TO INVENT is funded by

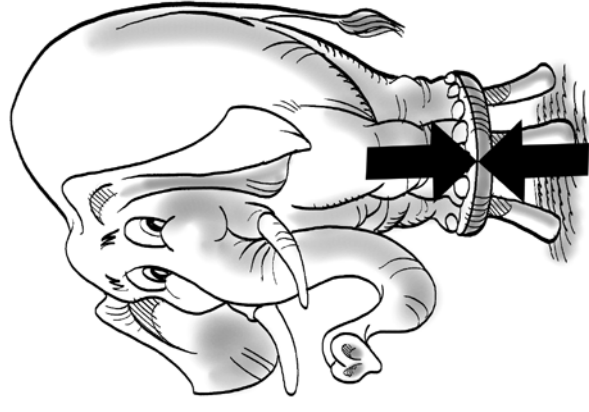
the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



TORRE DE TROFEOS



¡FELICITACIONES! Tu escuela ganó el torneo municipal de tenis. Para celebrar el triunfo, el alcalde quiere exhibir la pelota ganadora en la alcaldía. Pero la pelota necesita un pedestal en el que pueda posar.

El desafío

El cliente quiere que le diseñes y construyas una torre que sostenga una pelota de tenis a una altura de por lo menos 8 pulgadas.

1 Pensar y diseñar

- ¿Cómo puedes usar las pajitas para hacer una torre más fuerte que pueda sostener una pelota de tenis?
- ¿Cómo permanecerá la pelota de tenis encima de la torre de manera que no se caiga?
- ¿Cómo lograrás que la torre no se tambalee y caiga? (No se permite usar cinta pegante para pegarla a la mesa.)

2 Construir, ensayar y rediseñar

Pon la pelota de tenis encima de la torre. ¿Permanece ahí? Si no, hazte estas preguntas y modifica tu diseño.

• La torre se tambalea y se cae.

Observa la torre desde varios ángulos. ¿Está ladeada o se inclina? De ser así, cámbiale el diseño para enderezarla. ¿Qué tan ancha es la base? Con la base angosta, puede ser muy inestable.

• Las pajitas se doblan.

¿Porque se doblan? Dale fuerza a las pajitas o agrega soportes para que todas las partes de la torre ayuden a sostener la pelota.

3 Inventar más

- Haz una torre que sostenga dos pelotas de tenis.
- Diseña una torre de 16 pulgadas que sostenga una pelota.

SIGUE INVENTANDO

Inventa hoy

Mira un episodio de *Design Squad™ Nation* en tv o en internet, en pbskids.org/designsquadrnation.

Inventa esta semana

Dile a un adulto que te lleve al museo de ciencias. En la biblioteca municipal a veces hay entradas gratis.



El financiamiento de TIME TO INVENT CLUB proviene de la

the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.

HIT THE TARGET

Challenge

Invent a foot-activated ball launcher that can hit a target four feet away.

Client

A toy company, as described in Step 2

Agenda

- 1 Discuss the concept of a client.
- 2 Introduce the challenge.
- 3 Brainstorm design ideas for launchers.
- 4 Build, test, and redesign the launchers.
- 5 Share results and wrap up.

What success looks like today

Kids understand the client's role in the invention process, and they realize that they are using the design process as they build their launchers.

Get ready ahead of time

- Read these Leader Notes. To guide you as you run the session, make notes about key points, questions to ask, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout and the *Inventing for a Client* handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

Materials

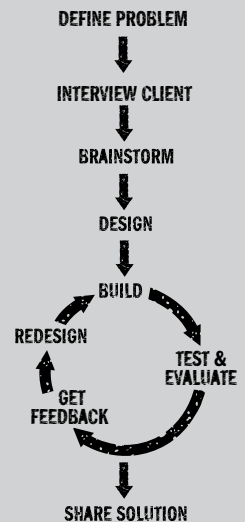
For the group

- ☐ 3–4 rolls of duct tape
- ☐ ruler
- ☐ pencils
- ☐ paper (scrap paper is fine)

Per pair

- ☐ 1 wooden spool
- ☐ 1 paint stirrer
- ☐ 1 Ping-Pong® ball
- ☐ 2 paper cups (3.5 oz)

The Design Process



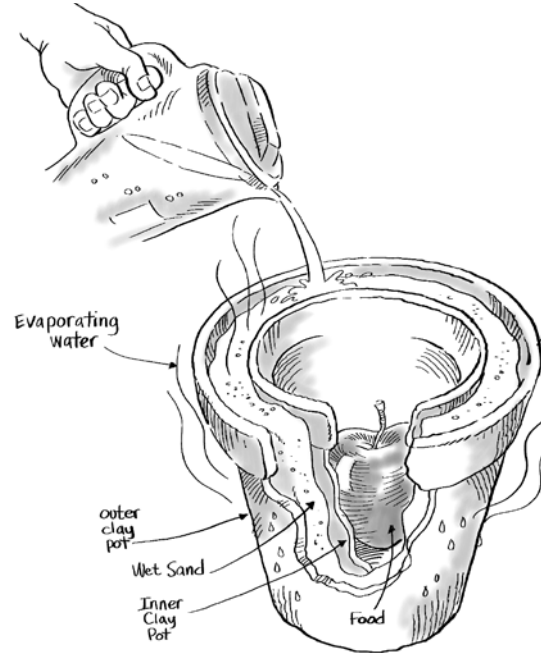
The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

1 Introduce the concept of a client (15 minutes)

Invention starts with a client

Inventors invent for a **client**—someone who will use the invention. Explain that, in the challenges to come, kids will work for clients, just as they did in Meeting 2. Tell kids that the invention process is about understanding a client's needs, inventing solutions, and getting feedback on the invention. To establish a common understanding of the term "client," ask kids:

- What is a client?
A customer, consumer, shopper, buyer, user, etc.
- Who has clients?
People who sell things or provide services. This includes anyone in business, such as store owners, doctors, landscapers, inventors, engineers, plumbers, car dealers, hairdressers, etc.
- As an inventor, how would you be sure that your design meets your client's needs?
You would talk with the client to make sure that your product or service solves their problem. The feedback can identify ways to improve the invention.



Meet a client

Give each kid an *Inventing for a Client* handout. To get them thinking about the ways an invention can benefit people, read aloud the story on the handout of an amazingly simple cooler. Then discuss the three questions at the bottom of the sheet. Possible answers to these three questions include:

On the Inventing for a Client handout, kids read about an amazingly simple cooler invented in Nigeria.

- 1 How could you or your family use a cooler like this one?
When riding in a car, going camping, meeting in a clubhouse, etc.
- 2 Where or in what situations would it be useful to have a cooler that doesn't use electricity?
Where the electricity goes out often, where people need to keep food or medicine cool when there is no refrigerator, etc.
- 3 Think of other people who could be potential clients for this invention.
Emergency workers, campers, schools, people who sell at farmers' markets, people who want to use less electricity for environmental reasons, etc.

② Define the challenge (5 minutes)

Engage the group

Ask: Who has ever invented a toy made from stuff lying around the house?

Have a few kids describe toys they invented. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

A popular toy company is looking for a fun way to sharpen kids' coordination and keep them physically active. The big toy convention is coming up, and all the engineers at the company are busy with other projects. The head of the toy company is turning to you to engineer a solution. Your client wants you to invent a toy that can launch a ball and hit a target four feet away, using only a person's feet!



Kids use their feet to launch a ball.

③ Brainstorm and design (10 minutes)

Discuss design ideas

- What are some ways to launch a ball with enough force so it will go four feet?
Build a lever or seesaw and stomp on one end. Attach a paint stirrer directly to your shoe. Make a pendulum-style arm that swings and hits the ball.
- What can you use for a target?
A box, trashcan, or piece of paper taped to the floor or wall.

What's a lever?

Levers are simple machines that make it easier for people to do work. They consist of a platform that pivots on a fulcrum. A seesaw is one kind of lever system. Depending on where the fulcrum is placed, levers can be used to change force or motion.

Discuss the design process

As usual, you'll be using the design process today. We've already brainstormed some ideas. What will the other steps look like today? Build? (*Building launchers*) Test? (*Checking regularly to see if the launcher can hit the target with a ball*) Redesign? (*Improving the design based on testing results*) Share? (*Trying out each others' launchers*)



Renée Mattier



Kids invent a variety of launcher designs—catapults, seesaw-like designs, and even ones made by directly attaching a paint stirrer to a shoe.

DESIGN PROCESS STEP

4 Build, test, and redesign (20 minutes)

Divide the group into pairs. Distribute the *Hit the Target* handout and materials. Circulate around the room and help teams troubleshoot issues that come up by asking questions. For example:

If the ball flies too far or not far enough, ask...

How do you change the force of a lever? Have kids experiment with the position of the fulcrum and figure out how to control the force on the ball. Eventually, they'll find a position that gets the ball to go where they want it to go.

If the launcher is inaccurate, ask...

What's the main reason your launcher is inaccurate? If the ball is in a different place every time, have kids make a holder for the ball to sit in. If the launcher shifts after every shot, mark the position of the parts so that when things shift, kids can set up the launcher the same way again.

Adjust the challenge level

Easier: Have kids start with a seesaw-like arrangement, with the spool under the middle of the paint stirrer.

More Difficult: Design a launcher that can hit a target six feet away.

⑤ **Wrap up** (10 minutes)

Reinforce key *Time to Invent* messages

Gather the group together. Have each team present its launcher. Ask follow-up questions, such as:

- Tell us about a problem you encountered and how you fixed it.
- Testing is one of the design process steps. How did testing help you refine your launcher?
- Now that you've invented a toy, how do you think engineers might use the design process to invent and design games?

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the launchers and lanyards.
- Let kids know that next week they'll build furniture—out of paper!
- (Optional) Send families this week's text or e-mail message. See page 176.

KEEP KIDS INVENTING

There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

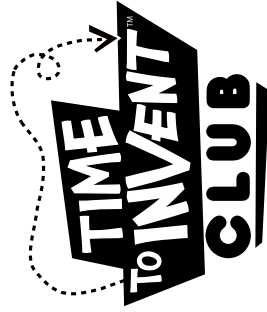
Invent today

Encourage kids to build a rubber band-powered racecar, a hidden alarm, or a confetti launcher. They can find these *Design Squad™ Nation* projects and dozens more at: pbskidsgo.org/designsquadnation.

Invent this week

Encourage kids to invent a game or toy and enter it in a contest, such as *TOYchallenge®* or *BKFK*. Find out more at: sallyridesience.com and at: bkfk.com.

DESIGNsquad
Nation



INVENTING FOR A CLIENT

In the world of invention, a **client** is a person who uses or benefits from an invention. For every invention, there are usually lots of clients. In fact, you are a client! Almost everything around you was invented with someone like you in mind.

Read this story about an invention called a Pot-in-Pot cooler.

The problem

Imagine a refrigerator that needs no electricity. An inventor in Nigeria did. Mohammed Bah Abba lives in a hot, dry area with no electricity. His challenge: to keep foods and medicines cool.

A solution

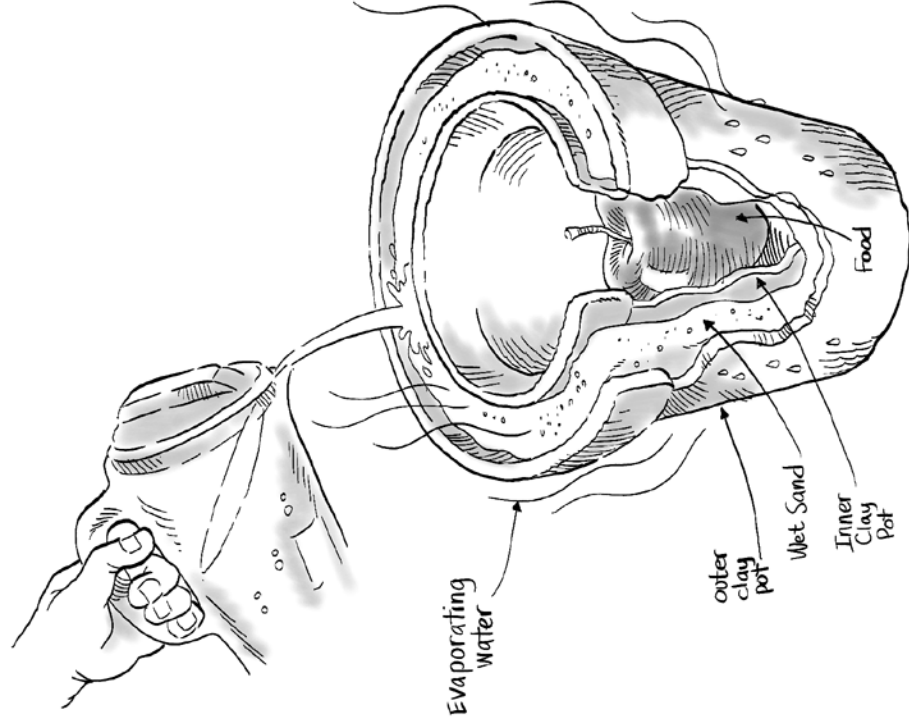
He invented a cooler made with just two clay pots and wet sand. That's all! He put a small pot inside a larger one and filled the space between them with wet sand.

How it works

In the hot desert, the water in the sand evaporates (turns to water vapor), carrying away heat from the pots. The inner pot stays cool as long as the water keeps evaporating.

Discuss who the clients are

- 1 How could you or your family use a cooler like this one?
- 2 Where or in what situations would it be useful to have a cooler that doesn't use electricity?
- 3 List other people who could be clients for this invention.



Check it out

Want to learn how it works? Want to make one? Find out at: cooperhewitt.org. Search for "pot-in-pot cooler."

TIME TO INVENT is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.

INVENCIONES PARA UN CLIENTE

En el mundo de las invenciones, el **cliente** es la persona que usa o se beneficia de la invención. Por cada invención, casi siempre hay muchos clientes. De hecho, ¡tú eres cliente! Casi todas las cosas que hay a tu alrededor se inventaron pensando en alguien como tú. Lee este relato sobre una invención llamada Maceta en maceta. (en inglés es *Pot-in-Pot cooler*).

El problema

Imaginate un refrigerador que funcione sin electricidad. Lo logró un inventor en Nigeria. Mohammed Bah Abba vive en una zona de mucha sequía y calor donde no hay electricidad. El desafío que enfrentaba era encontrar una manera de mantener fríos los alimentos y medicamentos.

Una solución

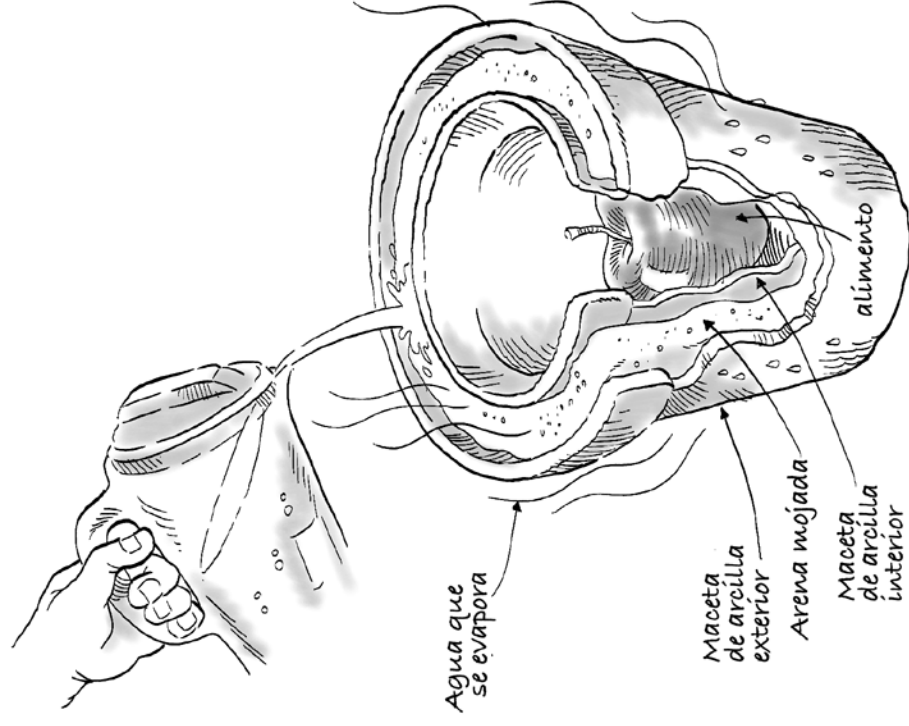
Inventó un enfriador con sólo dos macetas de arcilla y arena mojada. ¡Es todo! Colocó una maceta pequeña dentro de una grande y llenó el espacio entre ambas de arena mojada.

Cómo funciona

En el calor del desierto, el agua en la arena se evapora (se convierte en vapor), y se lleva consigo el calor de las macetas. La maceta interior permanece fría mientras el agua siga evaporándose.

Hablen sobre quiénes son los clientes

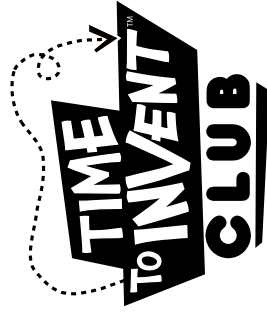
- 1 ¿Crees que a tu familia podría usar este tipo de enfriador?
- 2 ¿Dónde y en qué circunstancias convendría tener un enfriador que no tenga que usar electricidad?
- 3 Haz una lista de otras personas que podrían ser clientes de esta invención.



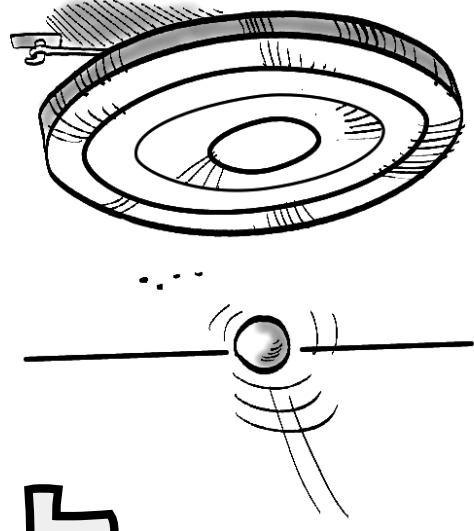
veamos

¿Quieres saber cómo funciona? ¿Quieres hacer uno?

Descúbrelo en: cooperhewitt.org. Busca "pot-in-pot cooler."



HIT THE TARGET



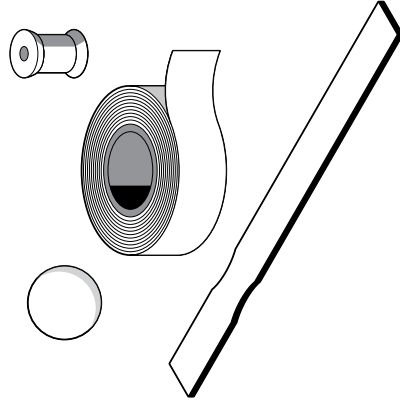
A popular toy company is looking for a fun way to sharpen kids' coordination and keep them active. The big toy convention is coming up, and all the engineers at the company are busy with other projects.

Challenge

Your client wants you to invent a toy that can launch a ball and hit a target that's four feet away, using only a person's feet!

Materials

- duct tape
- 1 paint stirrer
- 2 paper cups (3.5 ounces)
- 1 wooden spool
- 1 Ping-Pong® ball



1 Brainstorm and Design

- How can you use these materials to build a ball launcher?
- How can you use your foot to launch a ball and hit a target that's four feet away?
- What kind of holder will keep the ball on the launching platform?

2 Build, Test, and Redesign

Set the ball in place. Launch! Bull's-eye? If not, ask yourself these questions and revise your design:

- **Your ball goes too far or not far enough.**
How does the position of the spool affect how much foot-power gets through? Is the problem with the spool or with the paint stirrer?
- **Launcher is inaccurate.**
Can you identify the main reason your launcher is inaccurate? Is the ball in a different place every time? Does the launcher shift after every shot?

3 Invent Some More

- Design a launcher that can hit a target six feet away!
- Launch a ball straight up so you can catch it with your hands.

KEEP INVENTING

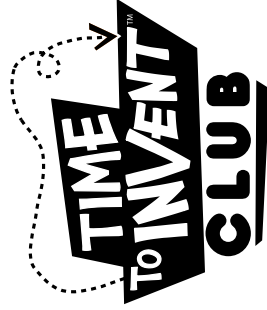
Invent today

Build a rubber band-powered racecar, hidden alarm, or confetti launcher. Find these projects and dozens more at: pbskids.go.org/designsquadrnation.

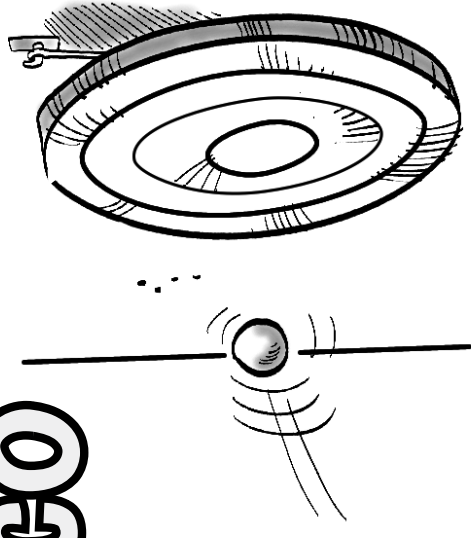
Invent this week

Invent a game or toy and enter it in a contest, such as TOYchallenge® or BKFK. Find out more at: sallyridescience.com and at: bkfk.com.

DESIGN squad
Nation



DAÑ EN EL BLANCO



Una fábrica de juguetes busca una manera divertida de aguzar las destrezas de coordinación de los niños y de mantenerlos activos. Se aproxima la feria del juguete y los ingenieros están muy ocupados con otros proyectos.

El desafío

Tu cliente quiere que inventes un juguete que pueda lanzar una pelota y darle a un blanco que está a 4 pies de distancia. Sólo se pueden usar ¡los pies!

Materiales

- cinta pegante plateada
- 1 palo para revolver pintura
- 2 vasos de cartón (de 3.5 onzas c/u)
- 1 carrete de madera
- 1 pelota de Ping-Pong®

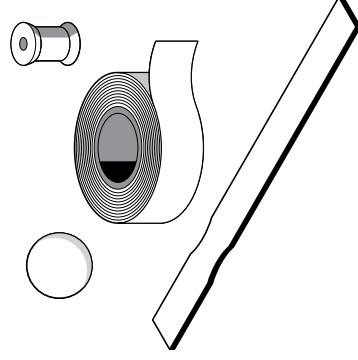
1 Pensar y diseñar

- ¿Cómo se pueden usar estos materiales para construir un lanzador de pelotas?
- ¿Cómo puedes usar el pie para lanzar una pelota y darle a un blanco a 4 pies de distancia?
- ¿Qué tipo de sujetador mantendrá la pelota en la plataforma de lanzamiento?

2 Construir, ensayar y rediseñar

Pon la pelota en su sitio. Lánzala. Distes en el blanco, ¿no? Si no, hazte las siguientes preguntas y modifica tu diseño:

- **La pelota avanza demasiado o muy poco.**
¿Qué efecto tiene la posición del carrete respecto a la fuerza que pasa por el pedal? ¿El problema lo ocasiona el carrete o el revolvedor de pintura?
- **Al lanzador le falta precisión.**
¿Puedes identificar el motivo principal de la falta de precisión del lanzador? ¿Colocas la bola en un sitio diferente cada vez? ¿El lanzador se mueve y cambia de lugar después de cada lanzamiento?



3 Inventar más

- Diseña un lanzador que pueda darle a un blanco que esté a 6 pies de distancia.
- Lanza una pelota hacia arriba y recíbela con las manos.

SIGUE INVENTANDO

Inventa hoy

Haz un carro de carreras con una liga de caucho, una alarma oculta, o un lanzador de confeti. Estos proyectos y muchos más los encuentras en: pbskids.org/designsquadrnation.

Inventa esta semana

Inventa un juego o juguete e inscribelo en un concurso como TOYchallenge® o BKFK. Entréate de detalles en: sallyridescience.com y a: bkfk.com.



El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention

Ping-Pong es marca registrada de Sop Services, Inc.

©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.



PAPER BRIDGE - PAPER CHAIR

Challenge: Build models of bridges and chairs out of paper.

Client: Club members will be their own clients.

Agenda

- 1 Introduce the challenge.
- 2 Explore ways of strengthening a weak material by building bridges out of paper.
- 3 Apply ideas from building paper bridges to making strong paper-chair designs.
- 4 Design and build at least two index-card models of portable, foldable chairs.
- 5 Share results and wrap up by discussing key ideas and reviewing the design process.

What success looks like today

Kids discover that changing paper's shape can strengthen it; they see that models allow inventors to test ideas quickly and cheaply before building something at full scale; and they build two chair models.

Get ready ahead of time

- Read these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Try the activities before doing them with kids.
- Bring a camera for taking photos of kids doing the challenge.
- Copy the challenge handout, one per kid.
- Have lanyards and stickers ready to distribute.
- **Looking ahead to Meeting 5:** Start collecting cardboard boxes, copier-paper box size and larger.

Materials

Paper Bridge (Per pair)

- ☐ 3 sheets of 8½ x 11-inch paper
- ☐ about 50 pennies (Get rolls of pennies at a bank.)
- ☐ books to make two even stacks about 4 inches high (Get them from the afterschool site.)
- ☐ 1 ruler for the mentor
- ☐ masking tape, cut into three 12-inch lengths

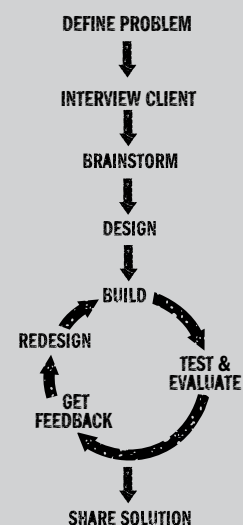
Chair models (Per pair)

- ☐ 5 index cards (3 x 5 inch)
- ☐ thin string or thread (approx. 1 foot per kid)

Group supplies (For both challenges)

- ☐ scissors
- ☐ clear tape

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

1 Define the challenge (5 minutes)

Engage the group

Ask: Who has ever gotten hurt by a piece of paper?

Have a few kids describe what happened, things like paper cuts, getting poked with a paper tube, or being hit in the eye with a ball of paper. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

Today, your challenge is to design a bridge and a chair. But there's a catch—the only material you can use is paper! Engineers find ways to make weak materials stronger. Think how tough cardboard is, even though it's just made from paper! And, as you just heard, certain shapes of paper can even hurt you!

2 Paper Bridge (10 minutes)

Tell kids that before they start building paper bridges and chairs, it's important to understand how to increase paper's strength.

DESIGN PROCESS STEP

Brainstorm and design (1 minute)

Do a quick demonstration. Set two 4-inch stacks of books six inches apart. Lay a flat sheet of paper across the gap. Place a penny in the middle. This "bridge" will collapse. Ask: How can you strengthen this piece of paper so it can hold the penny?

Change its shape—fold, crease, or roll it.

DESIGN PROCESS STEP

Build, test, and redesign (6 minutes)

Have kids work in pairs and build a bridge. Tell them to put the pennies in the middle of the bridge (in terms of both length and width) to ensure a fair comparison between different designs. Useful prompts include:

- How can you curve, roll, bend, or fold (or a combination of these) paper to make a bridge?
- How might the width affect the strength?
A narrow bridge is often stronger.

DESIGN PROCESS STEP

Share results (3 minutes)

Bring the group together. Ask:

- Which bridges held 20 pennies? 30? 40? All 50?
- What kind of folds and shapes strengthened the paper?
Triangles; tubes; accordion folds; beams made from L-shaped, U-shaped, or V-shaped folds; a "sandwich" of different layers; etc.
- Name some things made of paper where paper is bent or folded to make it stronger.
Paper cups and plates, boxes, corrugated cardboard

Adjust the challenge level

Easier: Narrow the gap under the bridge to 5 inches. Also, you can have kids use fewer pennies.

More Difficult: Build bridges that can hold 75 pennies. Or, widen the gap under the bridge to 7 inches.



To make a paper bridge, kids strengthen paper by changing its shape—folding, creasing, or rolling it.

③ Paper Chair (35 minutes)

Transition from bridges to chairs (1 minute)

Tell kids that what they learned about making strong paper bridges can be applied to making strong paper chairs. Today, they'll experiment with design ideas by making chair models out of paper. Then in the next two sessions, they'll turn their models into actual chairs that they can use during club meetings.

To make sure kids understand what you mean by the term "model," tell them that a **model** is a small version of something larger. Tell kids that models help inventors test design ideas quickly and cheaply before building something at full scale.

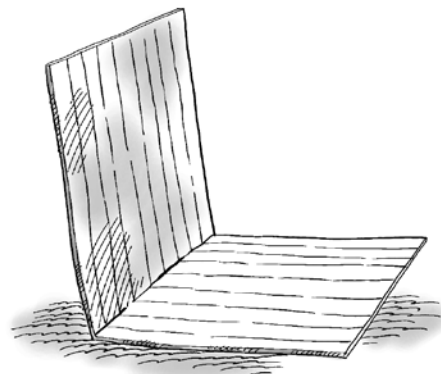
DESIGN PROCESS STEP

Define the problem (1 minute)

Let kids know that they need to build at least two chair models today. These models will allow them to refine their ideas before they build life-sized chairs in the next meeting.

Fold an index card into an "L" shape. (See illustration.) Press a finger against the chair back. It pushes right over! Explain that the kids' design challenge is to invent a way for their chair to firmly support a person leaning against it.

Distribute the *Green Lounger Chair Models* handout. Review the requirements listed at the top.



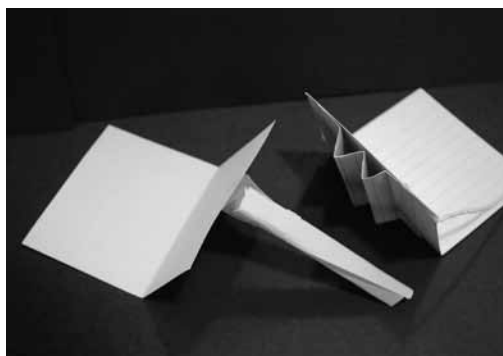
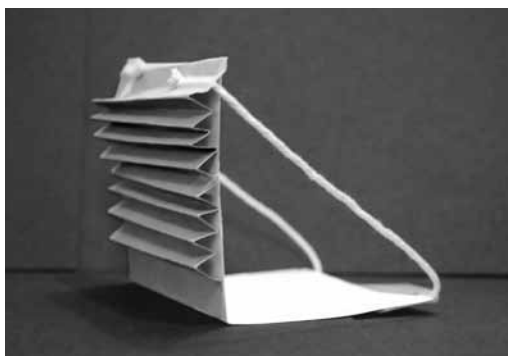
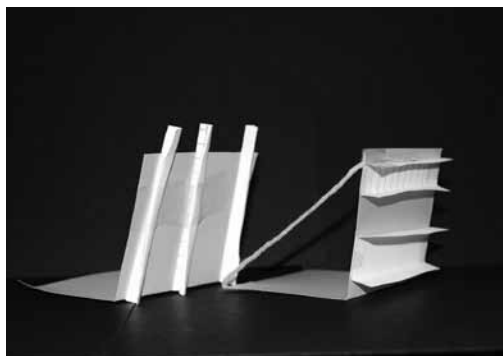
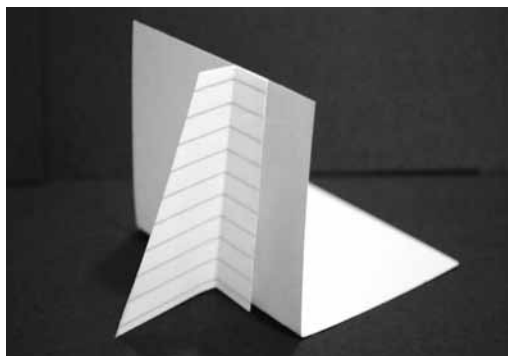
Working with index-card models lets kids test lots of design ideas quickly before they build something life sized.

DESIGN PROCESS STEP

Brainstorm chair designs (8 minutes)

Help kids apply what they learned about making paper stronger to making a chair by asking the questions below. If kids struggle to come up with design ideas during the activity, show them the photos on page 50.

- How could the shapes from Paper Bridge help you make a chair that's strong enough to lean against without having it buckle?
Tape tubes, beams, layers, or accordion folds across the back to stiffen and strengthen it.
- How can you use rope or string in your designs?
Run rope between the seat and back, the way many towers and poles use support wires.
- How can you use braces or tabs and slots to connect the parts of a frame?
Add diagonal supports or cut slots, similar to the bracing and tabs used to strengthen furniture, fences, and buildings.
- How can you prop up the back?
Use a tube of rolled-up cardboard, like an easel, or make a leg that swings out, like a tabletop picture frame.



To make a sturdy paper chair, kids apply what they learned in Paper Bridge about changing paper's shape to strengthen it. If kids struggle to come up with design ideas, show them these photos.

DESIGN PROCESS STEP

Build, test, and redesign (25 minutes)

Distribute the materials. As they build, ask:

- How can you make the chair back stronger and more rigid?
- Rope holds up well under tension. Where would it be most useful?
- How can you use tabs or slots to hold things together?

4 Wrap up (10 minutes)

Present the models

Have kids present their models and explain what makes their chairs strong.

Restate today's key concepts

Remind kids that in Meetings 5 and 6, they'll build life-sized chairs out of cardboard. Tell them that when making their chairs, they'll apply many of the ideas they learned today, particularly:

- Changing the shape of a weak material can make it stronger.
- Models let you test design ideas quickly and cheaply before building a life-sized version.

Reinforce key *Time to Invent* messages

- Today you used the design process. For example, we brainstormed bridge and chair designs, and you built models. What's an example of when you tested your bridge or chair and got an idea for redesigning it?
- How did today's challenge change the way you think about how engineers design everyday things like furniture?

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the lanyards and the bridges and chair models. Have kids initial them first!
- Let kids know that next week they'll be building some wacky furniture.
- (Optional) Send families this week's text or e-mail message. See page 176.

KEEP KIDS INVENTING

There are lots of ways to keep kids' inventing spirit alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

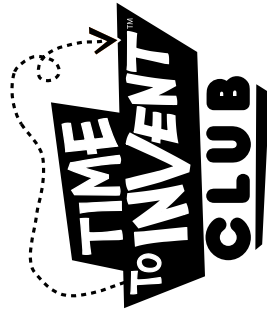
Invent this week

Encourage kids to play *Design Squad™ Nation's* online FIDGIT game. It promotes creative problem solving by having kids design a room that flips, rolls, and bounces these creatures safely into their box. Find it at: pbskidsgo.org/designsquadnation

Invent this week

Encourage kids to visit the *Design Squad™ Nation* homepage and check out the Projects section. They can see what other kids are inventing and to post photos and sketches of their inventions. Find it at: pbskidsgo.org/designsquadnation.

DESIGNsquad
Nation



GREEN LOUNGER CHAIR MODELS

Materials

- 5 index cards
- string or thread
- scissors
- tape

Challenge: Make models of at least two chairs that:

- have no legs—just a seat and back
- fold flat for storage
- have a strong back
- can be set up anywhere (i.e., no walls or table legs for support)

Client: You!



① Brainstorm and Design

Your chair models need to withstand a lot of force without bending.

- What supports can you add to make a strong, rigid back?
- Where and how should you add them?

② Build, Test, and Redesign

- Sketch some designs and build models of at least two of them, using index cards.
- Test each model, using your fist. (See illustration.)

③ Invent Some More

- Add features to your chair, such as a footrest, armrest, sunshade, or storage compartment.

Your fist represents you sitting in the chair. Slowly roll it backwards. When does the back give way?

KEEP INVENTING

Invent today

Save the FIDGIT! Design rooms that flip, roll, and bounce these creatures safely into their box. Play this game at: pbskidsgo.org/designsquadrn.

Invent this week

Get invention ideas, see what other kids are inventing, and post photos and sketches of your own inventions. Visit pbskidsgo.org/designsquadrn.

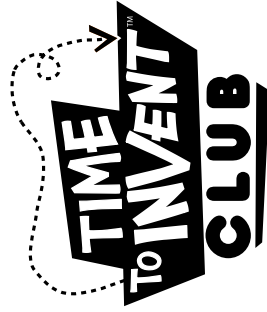


TIME TO INVENT is funded by

the Lemelson foundation
improving lives through invention



© 2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



MODELLOS DE TUMBONAS VERDES

Materiales

- 5 fichas de cartulina
- hilo o cuerda
- tijeras
- cinta pegante

El desafío: Haz modelos de al menos dos sillas tumbonas que:

- no tengan patas, sólo la posadera y el espaldar
- se puedan plegar para guardarlas
- tengan un espaldar resistente
- se puedan usar en cualquier sitio (es decir, no necesitan ni una pared ni patas para apoyarse.)

Cliente: ¡Tú!



① Pensar y diseñar

Los modelos de silla que diseñes tienen que poder resistir una gran cantidad de fuerza o presión sin doblarse.

- ¿Qué soportes puedes agregar para crear un espaldar fuerte y rígido?
- ¿En qué parte debes agregarlos y cómo se hace?

② Construir, ensayar y rediseñar

- Dibuja diseños y construye modelos de al menos dos de tus tumbonas. Usa las fichas de cartulina.
- Prueba cada modelo. Usa el puño (Mira la ilustración).

③ Inventa más

- Agrégale a tu silla otras funciones, como algo para reposar los pies, un posabrazos, una sombrilla contra el sol o un 'baúl' para guardar cosas.

El puño te representa a ti tumbado en la silla. Hazlo girar lentamente hacia atrás. ¿En qué momento cede el espaldar?

SIGUE INVENTANDO

Inventa hoy

Guarda el juego FIDGIT. Diseña cuartos en los que se puedan voltear, rodar o tambalear estas criaturitas sin peligro de daños. Puedes jugar este juego en: pbskidsgo.org/designsquadhation.

Inventa esta semana

Obtén ideas para inventar de lo que han inventado otros niños. Coloca fotos y dibujos de tus propias invenciones. Acude: pbskidsgo.org/designsquadhation.



El financiamiento de TIME TO INVENT CLUB proviene de la

the Lemelson foundation

improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.

GREEN LOUNGERS

Challenge

Invent a sturdy, foldable cardboard chair.

Client

Club members will be their own clients.

Agenda for Meeting 5

- 1 Introduce the challenge.
- 2 Brainstorm ways to turn the Meeting 4 models into life-sized cardboard chairs.
- 3 Start building, testing, and redesigning a Green Lounger chair.

Agenda for Meeting 6

- 4 Finish building, testing, and redesigning a Green Lounger chair.
- 5 Share results and wrap up.

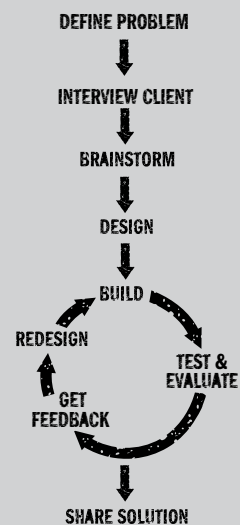
What success looks like

Kids apply the ideas generated while building models as they make full-scale chairs and see that the design process helps them develop effective solutions. By the end of Meeting 5, they have a chair well under way and complete their chair by the end of Meeting 6.

Get ready ahead of time

- Read these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Make a chair yourself so you can anticipate where kids might have difficulty.
- Copy the challenge handout and the optional *Client Feedback* sheet, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready, and gather the index-card models from Meeting 4.
- **Looking ahead to Meeting 8:** Make arrangements with the afterschool leader for getting the *Time to Invent* club members together with other kids in the afterschool program. Also, send home invitations inviting families to the celebration. (See page 59.)

The Design Process



The design process helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

Materials

Per kid

- ☐ cardboard boxes (2–3 boxes per kid, the size of a copier-paper box or larger)
If boxes are unavailable, buy corrugated cardboard sheets, 2 x 3 feet or larger. Provide 5 sheets per chair.

For the group

- ☐ 50 feet of clothesline
- ☐ markers
- ☐ duct tape
- ☐ 1–2 utility knives (for leaders only)
- ☐ scissors
- ☐ rulers

DESIGN PROCESS STEP

1 Define the challenge (10 minutes)

Engage the group

Ask: Who's ever invented a piece of furniture, like a seat, table, bed, or shelf?
Have a few kids describe furniture they invented. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

Today, your challenge is to invent a sturdy, foldable cardboard chair. And the client for this project is—YOU! The index-card models were a starting point for your chair designs. The next step is to make a life-sized cardboard chair inspired by the ideas you explored during the model-making stage.

You **do not** have to make one of your Meeting 4 models into a chair. You can, of course, but the models were a way to explore different design ideas and options. It's OK to use ideas from a bunch of different models.

Connect to the design process

In terms of the design process, what might the following steps look like today:
Brainstorming? (*Coming up with chair ideas*) Designing and building? (*Making the chair*) Testing? (*Seeing how well it works*) Redesigning? (*Improving things based on testing results*) Sharing? (*Trying each other's chairs*)



Kids make a life-sized cardboard chair inspired by the ideas they explored during the model-making stage.

② Brainstorm and design (10 minutes)

Feel the pressure

A full-scale chair is more challenging than an index-card model—there's a lot of weight to support and there are greater forces and stresses on it. The chair back has to support the full weight of someone who leans back. Divide kids into pairs. While they are sitting on the floor, have one partner lean back onto the other partner's hands. They will feel how much force the chair's back needs to support.

Brainstorm chair designs

Have kids brainstorm designs that address the following factors. Ask:

- Where might a chair's weak points be?
The back, where the ropes attach, etc.
- How can you make these weak points stronger or better supported?
Use bracing, ropes, supports, reinforcements, stiffeners, a "sandwich" of layers, etc.
- How can you help your design stand up to repeated use?
Reinforce joints, strengthen parts that support weight, etc.
- What challenges might come up when you make a full-scale chair?
Answers will vary.

③ Build (85 minutes, spread over two meetings)

Partner up

Although each club member will make his or her own chair in this challenge, kids can still explore the idea of "client." Have kids work in pairs to advise one another, with each partner offering ideas and feedback to the other. Remind kids of the club rule to be respectful and helpful in their comments. Start by assigning (or having kids choose) partners. Then explain that:

- Each kid has to check in with his or her partner at least three times during the building process.
- The "builder" will explain the design, point out any problems, and ask for feedback.
- The "advisor" will listen, test the chair, ask questions about the design, and offer ideas.

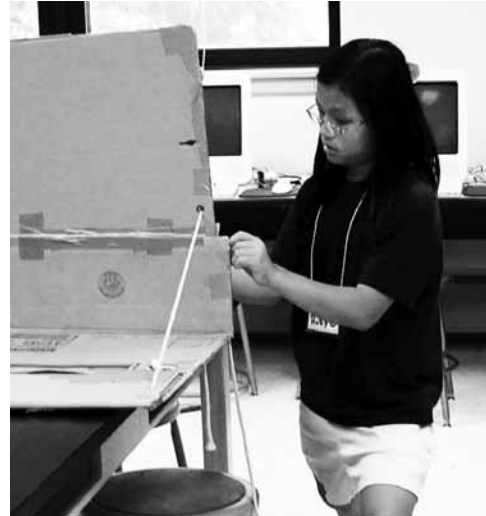


Provide large boxes for kids to unfold. Different boxes, with their different-sized flaps and creases, will inspire different designs.

Help kids build sturdy chairs

Distribute the materials. As kids build, help them identify ways to reinforce the back, such as:

- tape cross-braces, slats, tubes, or beams across the chair back, like a beach chair or kite
- use rope to hold up the back of the chair, like wires that support a tower or phone pole
- prop up the back with a pole or tube of rolled-up cardboard, like an easel
- swing out a “leg” to support the back, like a tabletop picture frame
- layer the cardboard, like plywood or corrugated cardboard
- reinforce a joint by taping a layer of cardboard over it, like a knee brace



Kids will spend the bulk of their time engineering ways to strengthen the back. Consider listing different ideas on a board or large sheet of paper.

Tips for cutting cardboard

Because ONLY the co-mentors and afterschool leader have the utility knives (a.k.a. box cutters), adults will cut the cardboard for kids. As kids figure out the shapes and dimensions of their chairs, tell them to use a marker to outline where they'll need cuts on the cardboard. To make the cuts:

- Always put some scrap cardboard down first to avoid nicking floors or tables.
- Cut using a series of gentle, shallow cuts. This works better than trying to make a cut in a single pass. It also helps to score both sides.
- ALWAYS keep the utility knife in your possession. Utility knives do not belong in kids' hands. REMEMBER: It's either in your hand or in your pocket.



When cutting cardboard, many gentle, shallow passes produce a far better—and safer—result than a few hard, deep cuts.

4 Test and redesign (ongoing)

Get feedback

As they did with their fists on the index-card models, tell kids to test their chairs by leaning back slowly, gradually increasing the force on their chairs. Also, have partners sit in each other's chairs and critique each other's designs. They can answer the questions on the optional *Client Feedback* handout in writing or orally. The "builder" should use the "advisor's" feedback to refine his or her chair.

Extra time?

Once kids have a working chair, they can add an enhancement or two, such as a canopy, cup holder, handle for carrying, multi-position back, armrest or footrest, decorative elements, or padding (e.g., bubble wrap or crumpled paper in a bag).

5 Wrap up (15 minutes at the end of Meeting 6)

Reinforce key *Time to Invent* messages

Gather the group together. Have each kid present his or her chair. Ask follow-up questions, such as:

- How did making models help you invent your chair?
- What obstacles did you overcome while building your chair?
- Testing is one of the design process steps. What did you learn during testing that helped you refine your chair?
- What kind of feedback did you get from your partner?
- Inventions improve people's lives. What are some advantages of using cardboard for making furniture?
Lightweight, strong, easy to cut with simple tools, inexpensive, easy to get, recyclable, etc.
- When they design, engineers always face some kinds of limitations or restrictions. For example, they can't always have all the materials, time, or money that they'd like! These limits are called **constraints**. What constraints did you face when you designed and built your chairs?
Restricted to building with cardboard, limited time, tape wasn't ideal for every joint, etc.
- How might engineers use the design process to design and build furniture for a client?

Connect to a real-world invention

Who else would benefit from a portable, storable chair? Kids' suggestions may include:

- campers, hikers, hunters, and fishermen
- toddlers and small children
- sports fans, parade watchers, and beach goers

Katrina Furniture Project

For information about making furniture from wood reclaimed after the hurricane, visit Cooper-Hewitt's "Design for the Other 90%" Web site: cooperhewitt.org. Search for "Katrina."

Add "disaster victims" to the list, if no one mentions it. Then make a real-world connection to today's challenge by introducing kids to the Katrina Furniture Project. (See box.) Describe how engineers are teaching people affected by the devastating 2005 hurricane in New Orleans to reclaim wood debris from the storm and turn it into tables, stools, church pews, and other furniture to replace lost and damaged items.

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the chairs and lanyards.
- If you have them ready now, give kids invitations inviting families to the Meeting 8 celebration. (See page 59.)
- Let kids know that next week they'll have an electrifying experience!
- (Optional) Send families this week's text or e-mail message. See page 176–177.

KEEP KIDS INVENTING

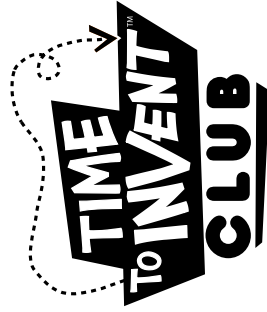
There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

Invent today

Encourage kids to try some engineering challenges based on bridges, skyscrapers, tunnels, dams, and domes. Find them at: pbs.org/wgbh/buildingbig/lab.

Invent this week

Encourage kids to ask a teacher if their school has a Tech Ed. class, participates in competitions such as *Future City Competition*[™], or runs clubs like *First[®] LEGO[®] League* or *Science Olympiad*.



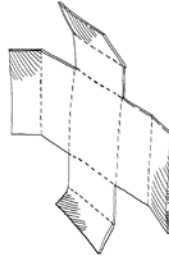
GREEN LOUNGERS

A club is more fun when you build part of it. And it's more personal when you have your own special place.

Challenge
Design a portable chair that the client—YOU!—can fold flat and that won't collapse when you sit in it.

Materials

- duct tape
- ruler
- marker
- clothesline (6 feet)
- scissors
- 2 large cardboard boxes (unfold the boxes to get your cardboard.) No boxes? Use 5 flat pieces of corrugated cardboard (about 2 x 3 feet).



① Brainstorm and Design

- What did you learn from the index-card models about making a sturdy chair?
- What changes will you make for a life-sized chair?

② Build, Test, and Redesign

Your chair has to support a lot of weight.

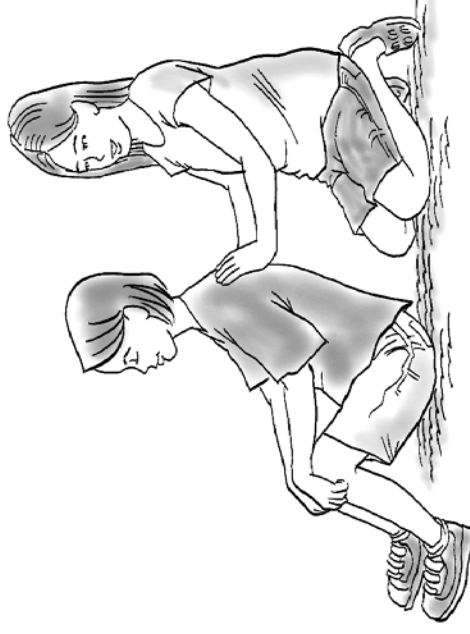
- How will you shape the materials to make them stronger?
- What are the chair's weakest parts and how can you reinforce them?
- How will you keep the back support from falling over?

Test your design.

- Test and redesign until you can lean back fully.
- Make sure the chair is still foldable.

③ Invent Some More

How about adding a cup holder? An armrest or footrest? Or handles for carrying the chair?



Lean back onto your partner's hands to get a sense of how much pressure a chair must support when someone leans back.

KEEP INVENTING

Invent today

Bridges, skyscrapers, tunnels, dams, and domes need your help. Try these engineering challenges at: pbs.org/wgbh/buildingbig/lab.

Invent this week

Ask a teacher if your school has a Tech. Ed. class, participates in competitions such as Future City Competition™, or runs clubs like First® LEGO® League or Science Olympiad.

TIME TO INVENT is funded by

the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.

El club es más divertido si tú has construido parte del mismo. Y es más personal cuando tienes un sitio especial para ti.

El desafío

Diseña una silla portátil que el cliente —o sea, ¡TÚ!— pueda plegar (para guardarla) y que no se desplome cuando te sientes.

1 Pensar y diseñar

- ¿Qué aprendiste de los modelos de cartulina sobre cómo se construye una silla sólida y resistente?
- ¿Qué cambiarías si fuera una silla de tamaño real?

2 Construir, ensayar y rediseñar

La silla tiene que resistir mucho peso.

- ¿Qué forma les darás a los materiales para que sean más resistentes?
- ¿Cuáles son las partes más débiles de la silla y qué se puede hacer para reforzarlas?
- ¿Qué harás para que el espaldar no se caiga?

Pon a prueba tu diseño.

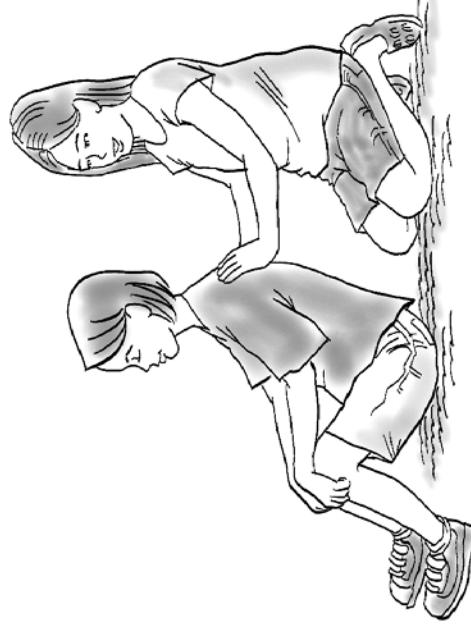
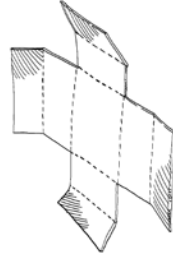
- Ponlo a prueba y vuelve a diseñarlo hasta que te puedas rescostar completamente sobre el espaldar.
- Asegúrate de que la silla siga siendo plegable.

3 Inventa más

¿Le podrías agregar un portavasos? ¿O un posabrazos o algo para descansar los pies? ¿O qué tal agarraderas para transportar la silla de un sitio a otro?

Materiales

- cinta pegante plateada
- regla
- marcador
- lazo para tendedero (6 pies)
- tijeras
- 2 cajas de cartón grandes (desplégalas para usar el cartón). ¿No tienes cajas? Usa 5 trozos planos de cartón corrugado (de unos 2 x 3 pies).



Recuéstate contra las manos de tu compañera para que te enteres de más o menos cuánta presión debe soportar una silla cuando alguien se tumba hacia atrás.

SIGUE INVENTANDO

Inventa hoy

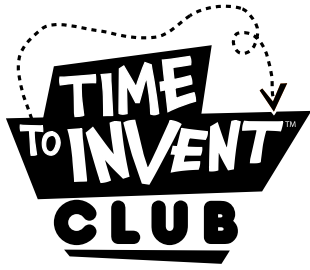
Los puentes, rascacielos, túneles, domos y las presas necesitan tu ayuda. Encontrarás desafíos de ingeniería en: pbs.org/wgbh/buildingbig/lab.

Inventa esta semana

Pregunta a un maestro si la escuela tiene un curso de Educación técnica, si participa en concursos tales como Future City Competition™, o en clubes como First® LEGO® League o Science Olympiad.

El financiamiento de TIME TO INVENT CLUB proviene de la

the Lemelson foundation
improving lives through invention



Green Lounger Chairs: Client Feedback

Client(s) name(s): _____

Inventor(s) name(s): _____

Welcome to my chair! Try it out.

1 Does the chair...

☐ use earth-friendly ("green") materials?

☐ fold flat for storage?

☐ support your weight?

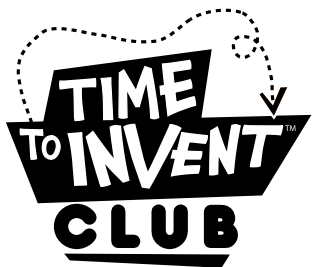
☐ feel comfortable?

☐ seem light enough to carry?

2 What are one or two things you like about the design?

3 What improvements would you suggest?

4 What cool features would you like me to add?



Sillas tumbonas verdes: Comentarios del cliente

Nombre del cliente o clientes: _____

Nombres del inventor o inventores: _____

Bienvenido a mi silla. Pruébala.

1 La silla...

☐ ¿usa materiales que no hacen daño al medio ambiente (materiales "verdes")?

☐ ¿se puede plegar fácilmente para guardarla?

☐ ¿puede soprotar tu peso?

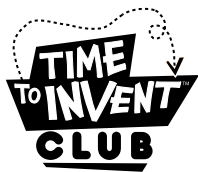
☐ ¿es cómoda al sentarse?

☐ ¿parece ser lo suficientemente liviana para cargarla?

2 ¿Cuáles son una o dos cosas que te gustan del diseño?

3 ¿Qué mejoras podrías sugerir?

4 ¿Qué características interesantes quieres que le agregue a la silla?



CELEBRATION INVITATION

The Time to Invent club is having a celebration,
and you're invited! Come and support your kids and
see what they've been working on.

Refreshments will be served!

The Time to Invent celebration will be on:

_____ from _____ to _____
(Date) (Time)
at _____
(Location)

We look forward to seeing you there!

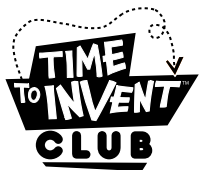
(Co-leaders of the Time to Invent club)

TIME TO INVENT is funded by

the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.



Invitación a la Celebración

¡El club Time to Invent realizará una gran celebración,
y esta invitación es para ti! Te convidamos a demostrar
tu apoyo por los niños y a ver lo que ellos han hecho estas semanas.

Habrà refrigerios para degustar.

La celebración del club Time to Invent será el:

_____ de las _____ a las _____
(Fecha) (Hora)
en _____
(Lugar)

Será un placer contar con tu presencia.

(Co-líderes del club Time to Invent)

El financiamiento de TIME TO INVENT CLUB proviene de la

the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT y el logotipo asociado son
marcas registradas de WGBH.

BUZZ BOARD

Challenge

Build a game that incorporates magnets and a battery-operated buzzer.

Client

Baseball team's business manager, as described in Step 1

Agenda

- 1 Introduce the challenge.
- 2 Review electric circuits.
- 3 Brainstorm game ideas.
- 4 Invent, build, and test Buzz Board games.
- 5 Wrap up and prepare kids for presenting their projects at the Meeting 8 celebration.

What success looks like today

Kids understand how circuits and switches work, use the design process to come up with fun games, and are ready to host the Meeting 8 celebration.

Get ready ahead of time

- Read these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout, one per kid.
- Have kids' Green Loungers on hand for Steps 1 and 6.
- Cut lengths of electrical wire (see materials) and strip the ends with wire strippers, unless the kids can do this themselves.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.
- **Looking ahead to Meeting 8:** Make arrangements with the afterschool leader for getting other kids in the afterschool and families to attend next week's celebration. Also, ask him or her to prepare a few comments about his or her club experience. (See page 86.) Scan Meeting 8's Leader Notes. Decide whether you'll do Option A or Option B for the mini challenge. If you've taken photos during club meetings, figure out a way to share them (e.g., a slideshow or display of printed photos). Finally, if you've not yet done so, send home invitations inviting families to the celebration.

Materials

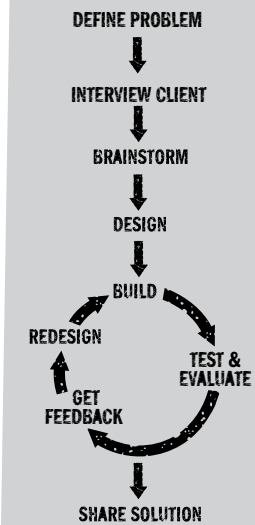
For the group (six pairs)

- ☐ 1 box of paper clips
- ☐ 6 pencils
- ☐ 3 tennis balls
- ☐ 6 rolls of tape (electrical, masking, or duct)
- ☐ 3 wire strippers
- ☐ 1 ball of string
- ☐ 1 roll aluminum foil
- ☐ 6 scissors

Per pair

- ☐ 1 buzzer
- ☐ 1 AA battery in a battery holder (You can also use 9-volt batteries with snap tops. AA batteries work well, but 9-volt batteries activate the buzzer more instantaneously and produce a louder sound. See note on page 15.)
- ☐ 2 magnets (either disc or square/rectangular magnets ½-inch diameter and up, or 1 x 1-inch squares cut from a flexible magnetic sheet)
- ☐ 2 4 x 6-inch sheets of chipboard or cardboard (scrap cereal box is fine, as is corrugated)
- ☐ 2 lengths of electrical wire (10–12 inches long) with the ends stripped

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

1 Define the challenge (5 minutes)

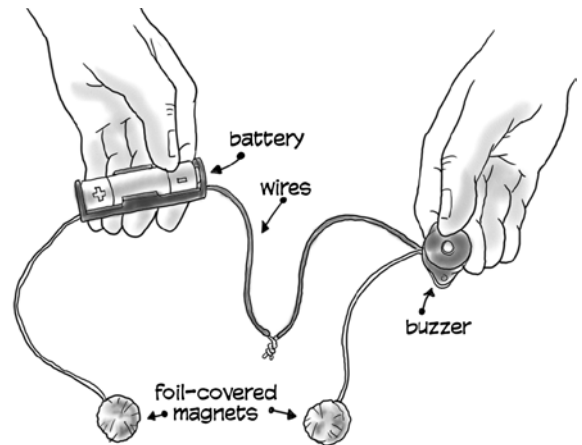
Engage the group

Ask: Who's ever invented a game or toy, even something simple made from sticks, marbles, or buttons?

Have a few kids describe toys or games they invented. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

The city's baseball team is looking for a fun way to create some "buzz" in the stands. They want a simple game that turns a buzzer on and off. The business manager has asked the *Time to Invent* club to invent a battery-operated game that uses a buzzer. If your game catches on, the whole world will be buzzing about it!



2 Review circuits (10 minutes)

Make the buzzer buzz

Give kids a warm-up challenge—make the buzzer buzz. Try this:

- Divide the group into pairs and give each one a battery in a holder and a buzzer.
- Challenge each pair to make their buzzer buzz.
- Once all pairs have succeeded (a minute or two), collect the batteries and buzzers. This will keep the buzzers from being a distraction.

Identify the parts of a circuit

The game uses a circuit, so it's important to review the basics. Demonstrate by taking one of the kids' battery-buzzer setups and connecting the wires to make the buzzer buzz. Ask:

- What supplies the electricity to make the buzzer buzz?
The battery
- What connects the buzzer to the battery?
The wires. Show how their ends are stripped to expose the metal inside the plastic coating. Tell kids that you have wire strippers if they ever need more wire to be exposed.
- How does the color of the wires factor into making the buzzer buzz?
The buzzer won't work unless the same color wires are connected—either red-to-red or black-to-black. To work, electricity has to flow through the buzzer in a specific direction.

Define a switch

- Hold the battery and buzzer so the two free end wires don't touch. Ask: What should I do to close the circuit?
Touch the two free ends together.
- With the buzzer buzzing, ask: How do you get this thing to stop?
Separate the wires.
- Why does a gap turn the buzzer off?
When there's a gap, electricity won't flow, so the buzzer won't sound.
- Tell kids to look around the room and find a device that opens and closes a circuit.
A switch on a light, computer, TV, cell phone, etc.
- Show kids how they can make the world's simplest switch! Close the circuit by touching the free ends of the circuit's wires together. Open it by separating the wires.



Magnets help kids make a simple switch that dependably closes the circuit.

③ Make a magnetic switch (5 minutes)

The kids' games rely on a switch. Using magnets, kids can make a simple switch that easily and dependably closes the circuit and lets electricity flow. Show kids how to make a magnetic switch.

Show how to make magnets conductive

Tell kids that most magnets don't conduct electricity. (Commercial magnets are often plastic or ceramic.) To make them conductors, kids need to wrap the magnets in something that conducts electricity. Wrap two magnets in foil.

Demonstrate a magnetic switch

Tape a foil-wrapped magnet to each of the circuit's free wires. Make sure the metal part of the wire touches the foil. Dangle the magnets in the air. Ask:

How can these magnets work as a switch?

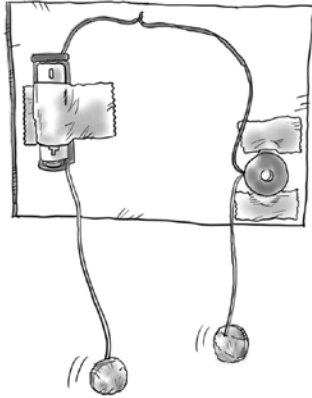
If the magnets get close enough, they'll snap together, closing the circuit and letting electricity flow.

4 Brainstorm game ideas (5 minutes)

Making a buzzer game means figuring out how to incorporate a switch into the game. Below are sample ideas for games that kids can make. Use the questions to get them thinking about different ways to incorporate a magnetic switch into a game.

Mid-Air Collision

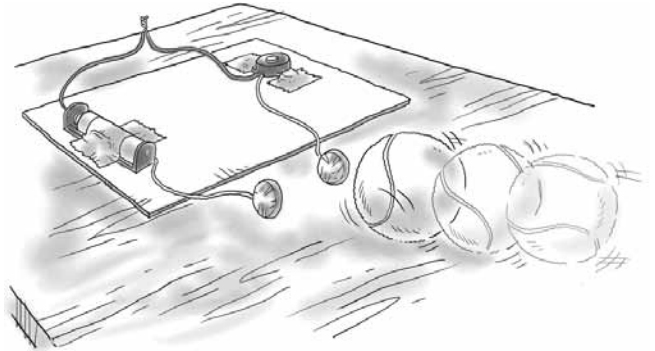
What kind of game might use magnets that dangle in the air?



Mid-Air Collision: Shake the cardboard until the magnets connect.

Squeeze Play

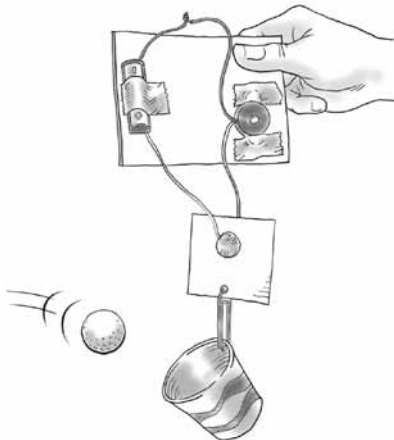
What kind of game might use a ball to push the magnets together?



Squeeze Play: Roll a ball at the magnets and try to knock them together.

Drop Out

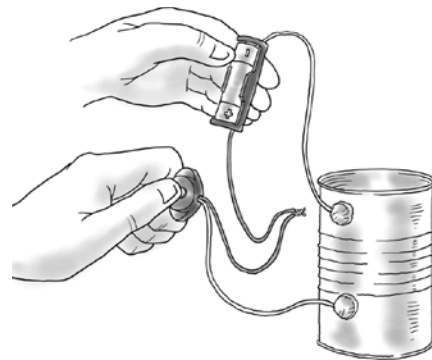
Stick two magnets together with a piece of cardboard between them. Ask: What kind of game could you invent to pull the cardboard out so that the magnets can snap together and close the circuit?



Drop Out: Once you pull the cardboard from between the magnets, they will connect, completing the circuit and buzzing the buzzer. Kids could tie a cup or ring to the cardboard. Then they could toss weights into the cup or try to grab the ring.

Conductivity Treasure Hunt

How could you use the circuit to hunt for things in this room that conduct electricity?



Conductivity Treasure Hunt: Have kids place the magnets on objects in the room, such as file cabinets, chair legs, and radiators. If it conducts electricity, then it will close the circuit and buzz the buzzer. See how many objects kids can find that will sound the buzzer. (NOTE: Some paints don't conduct, which can give an unexpected result.)

5 Build, test, and redesign (25 minutes)

Distribute the handout and materials. Help kids if the following challenges come up:

If the buzzer doesn't buzz, ask...

Are there any loose wires, ends that need to be stripped more, or incorrect wiring (i.e., not red-to-red or black-to-black)? Help kids troubleshoot their circuits.

Adjust the challenge level

Easier: Provide kids a single option, such as Mid-Air Collision. Also, you can wire together the battery-buzzer sets ahead of time for the kids as well as attach the foil-covered magnets.

More Difficult: Have kids invent two games.

If the wires are too short to work well, ask...

How can you make the wires longer? Let them know that they can make the circuit bigger simply by adding lengths of wire to the circuit.

If wires need a bigger contact area to work well, ask...

How can you enlarge the contact area? Some games need a contact area that's larger than just a magnet. Kids can tape large pieces of foil to each magnet. Any foil connected to a wire becomes an extension of that wire, so when the pieces of foil touch, the circuit closes.

If kids seem stuck, ask...

Have you had other kids play your game? Encourage kids to get feedback about ways to improve the game and the circuit.

6 Wrap up (10 minutes)

Reinforce key *Time to Invent* messages

Gather the pairs together. Have each team present its game. Ask follow-up questions, such as:

- Brainstorming is one of the design process steps. How did thinking about different possibilities influence the game you invented?
- Testing and getting client feedback are important design process steps. How did testing and having others play your game help you refine your Buzz Board?
- What are some ways engineers might be involved in developing games?
Designing sports equipment, programming video and computer games, inventing new game ideas, etc.



Kids can make their circuit bigger by adding lengths of wire.

Prepare for Meeting 8

Tell kids that Meeting 8 will be a celebration of the work they have done in the *Time to Invent* club. Other kids from the afterschool program will come to the club to see the six projects that club members have made (straw tower, ball launcher, paper bridge, chair models, chair, Buzz Board).

As hosts, tell club members that they will have the following responsibilities:

- **Give short presentations of each project.** A presenter will describe the challenge, say who the client was, and mention something he or she liked about the activity.
- **Facilitate a small group of guests in a mini challenge.** Club members will lead a quick brainstorm session, assist with materials, keep things on schedule, and deal with issues that come up. The goal is to help their group have fun and be successful. Tell kids that facilitating means helping the guests do the challenge rather than doing it themselves.
- **Party!** There will be refreshments.



Help kids spot loose wires, ends that need to be stripped more, and incorrect wiring.

To get some logistics out of the way, do the following:

- **Form pairs.** Ask who plans to be here next week. Then divide kids into pairs (or small groups).
- **Assign each pair a project.** Assign a pair to a particular challenge.

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see page 80.) Congratulate kids on a successful session and award the membership stickers.
- If you haven't yet done so, give kids invitations inviting families to the Meeting 8 celebration. (See page 71.)
- Collect the games and lanyards. (Save the Buzz Board games so guests can play them at the celebration. You will ultimately need to disassemble the Buzz Boards so the batteries and buzzers can be reused in a later meeting.)
- (Optional) Send families this week's text or e-mail message. See page 177.

KEEP KIDS INVENTING

DESIGNsquad
Nation

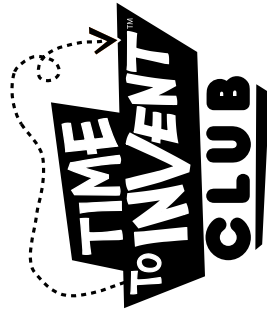
There are lots of ways to keep kids' inventing spirit alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

Invent today

Encourage kids to meet cool young engineers who fly blimps, race go-karts, design roller coasters, and build robots that swim. Have them watch these short videos at: pbskidsgo.org/designsquadnation.

Invent this week

Encourage kids to talk to an afterschool leader or teacher about summer science or invention programs offered by local schools, libraries, community centers, or science museums. For example, meet other inventive kids at Camp Invention® (invent.org/camp).



BUZZ BOARD

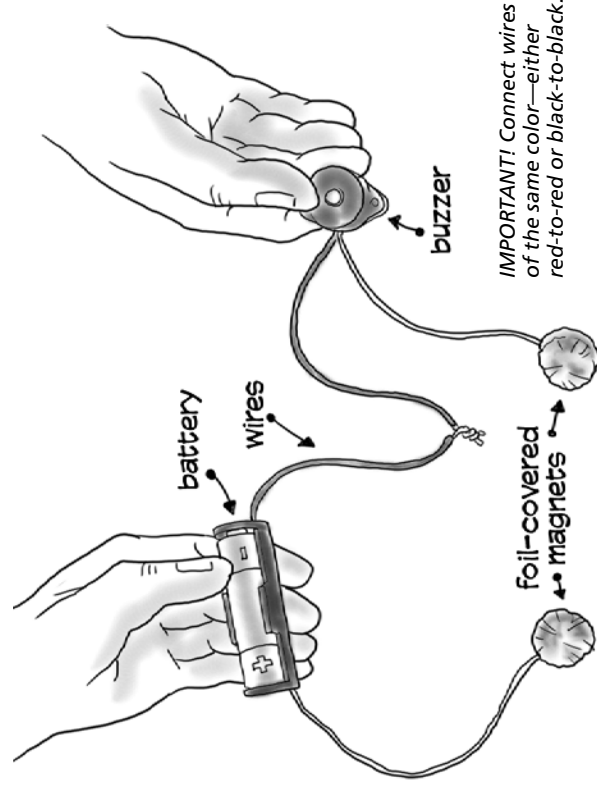
The city's baseball team is looking for a fun way to create some "buzz" in the stands. They want a simple game that turns a buzzer on and off.

Challenge

Your client wants you to build a game that incorporates a battery-operated buzzer.

Materials

- 1 AA battery in a battery holder
- 1 buzzer
- 2 4x6-inch sheets of cardboard
- 2 magnets
- aluminum foil
- 2 lengths of electrical wire, 10–12 inches long with the ends stripped



① Brainstorm and Design

- What's the purpose of the game and how does someone win?
- How will your circuit set off the buzzer?

② Build, Test, and Redesign

- Put the circuit together. If appropriate for your game, mount it to the cardboard.
- If your buzzer doesn't work, check for: loose wires, wire ends that need to be exposed more, or incorrect wiring (it needs to be either red-to-red or black-to-black).
- Have others play your game and suggest ways to improve it.

③ Invent Some More

- Make your Buzz Board more attractive so people will want to buy it.
- Invent a second game that you can play with your Buzz Board.

KEEP INVENTING

Invent today

Meet cool young engineers who fly blimps, race go-karts, design roller coasters, and build robots that swim. Watch these short videos at: pbskids.go.org/designsquadnation.

Invent this week

Meet other inventive kids! Talk to an afterschool leader or teacher about summer science or invention programs offered by local schools, libraries, community centers, or science museums.

TIME TO INVENT is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.

TABLERO ZUMBADOR

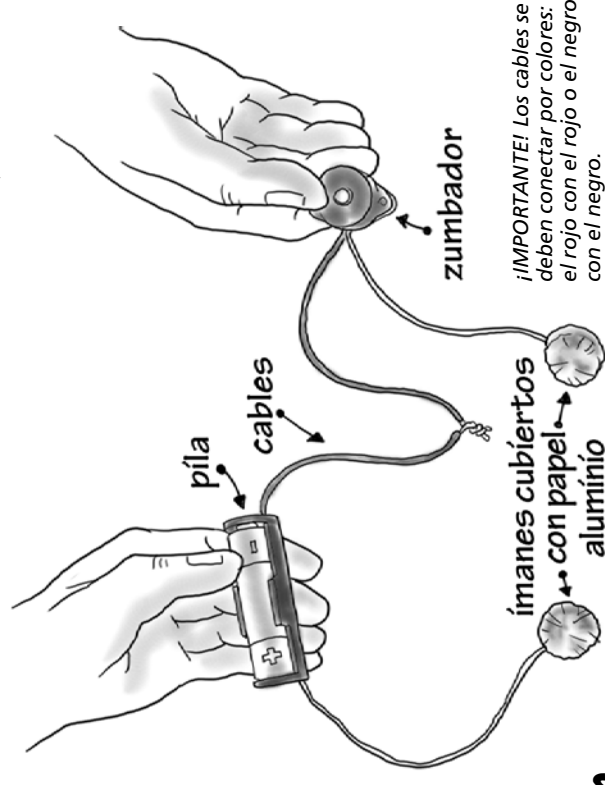
El equipo de béisbol de la ciudad busca una manera divertida de crear un "zumbido" en las graderías. Quieren un juego sencillo que haga encender y apagar un zumbador.

El desafío

Tu cliente quiere que le construyas un juego que incorpore un zumbador activado por una pila.

Materials

- 1 pila AA en su portapilas
- 1 zumbador
- 2 hojas de cartón de 4x6 pulgadas
- 2 imanes
- papel de aluminio
- 2 trozos de cable eléctrico, de 10 a 12 pulgadas de largo con los cabos expuestos



¡IMPORTANTE! Los cables se deben conectar por colores: el rojo con el rojo o el negro con el negro.

1 Pensar y diseñar

- ¿Cuál es el objetivo del juego y cómo se decide quién gana?
- ¿Cómo funcionará el circuito para activar el zumbador?

2 Construir, ensayar y rediseñar

- Arma el circuito. Si cuadra con tu diseño, móntalo sobre el cartón.
- Si no funciona tu zumbador, revisa que no haya cables sueltos, que los cabos estén bien expuestos, que las conexiones estén correctas (rojo con rojo o negro con negro).
- ¿Pídeles a otros que jueguen tu juego y que te sugieran maneras de mejorarlo.

3 Inventa más

- Dale un aspecto más atractivo a tu Tablero zumbador para que el público lo quiera comprar.
- Inventa un segundo juego que se pueda jugar con tu Tablero zumbador.

SIGUE INVENTANDO

Inventa hoy

Conócese con ingenieros jóvenes que vuelan zepelines, apuestan con karts, diseñan montañas rusas y construyen robots que nadan. Puedes ver videos breves en: pbskids.org/designsquadsnation.

Inventa esta semana

Conócese con otros niños inventores. Habla con un líder escolar o con tu maestra sobre programas de verano sobre ciencias o inventiva que ofrezcan las escuelas, la biblioteca, el centro comunitario o el museo de ciencias.

El financiamiento de TIME TO INVENT CLUB proviene de la

the Lemelson foundation
improving lives through invention

SHOW & TELL CELEBRATION

Overview: Have fun and share the club with others.

Client: Invited guests: Family members and other kids and leaders in the afterschool

Agenda

- 1 Welcome guests, introduce leaders, and describe the club.
- 2 Present kids' inventions.
- 3 Do a mini invention challenge with the guests (Option A or Option B).
- 4 Party!

What success looks like today

Club members present their work effectively, and they successfully lead guests in a challenge. Everyone leaves having had fun and with a good impression of the *Time to Invent* club.

Get ready ahead of time

- Confirm with your afterschool partner the number of guests attending the celebration and that they know when and where to arrive.
- Make sure club members are ready to present the projects.
- Select the mini invention challenge for guests to do. See Step 3 for the two options. Consider the age and ability of your guests. Have the materials for the option you choose ready for quick distribution. If you are doing Option B, have the afterschool leader divide the guests into groups of three or four. Doing this ahead of time will help the group get started faster.
- Finalize the display of printed photos or slideshow.
- Arrange the tables and chairs in the room, and set out drinks and snacks.
- Set up stations to display kids' inventions. Include several examples of each challenge, and be sure every club member has something displayed. If stations don't work in your space, place the inventions on a central table.

Materials

For Option A, see Meeting 1.

For Option B: (For the group)

- | | |
|--|--|
| <input type="checkbox"/> Newspaper Clothes facilitator sheet (Each club member gets a copy.) | <input type="checkbox"/> 2 rolls masking tape (Each team gets 3 feet.) |
| <input type="checkbox"/> newspaper (Bring plenty. Each team gets 6 sheets.) | <input type="checkbox"/> 10 plastic grocery bags (optional) |
| <input type="checkbox"/> scissors | <input type="checkbox"/> scrap cardboard (optional) |
| <input type="checkbox"/> 2 rolls of duct tape (Each team gets 3 feet.) | |

1 Welcome and Introductions (10 minutes)

Welcome

The afterschool program leader should welcome guests to this special *Time to Invent* event. The kids and families know the program staff, so this is an effective way to establish the connection between the afterschool program and the *Time to Invent* club. Tell the guests that today is about having fun, checking out what's happening in the club, and giving kids not in the club a sneak preview of what they can sign up for next time the club is offered. Encourage other kids to join the club (if it will be offered again), especially if there are fourth graders in the audience.

Before introducing the co-mentors, the afterschool leader should share something about his or her experience. For example:

- Congratulate the club members on their creativity and hard work.
- Mention the impact the club has had on the afterschool program.
- Share what he or she has learned about invention through participating in the program.

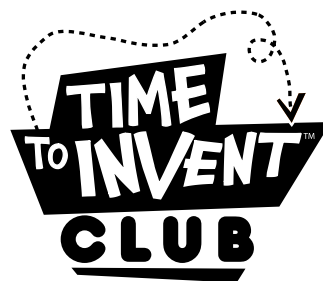
Introduce the mentors

Mentors should thank the afterschool staff for hosting the program. Then share some things about yourselves. For example:

- Your names and what you do for work or what you study at school
- How you got involved with the *Time to Invent* club
- What you've learned from participating in the program
- Some highlights and funny moments from the first seven weeks of the club

Describe the club

Let guests know that *Time to Invent* is an invention club where kids tackle fun challenges and come up with creative solutions. Mention some of the projects the club members have done over the past seven weeks. Then, explain that today the club members have put together a special presentation for their guests.



② Showcase inventions (10 minutes)

Have club members give a one-minute presentation of each of the projects displayed. Ask them to describe the challenge, the client for each challenge, and what they built. If presenters get stuck, here are a couple of helpful prompts:

- Tell us what you liked about this challenge.
- Tell us who the client for this invention was.
- Tell us about some of the different solutions the group came up with.
- Tell us about the biggest problem you overcame.

③ Do an invention challenge (25 minutes)

Here's a chance for the guests to try their own invention challenge and get a sense of what the *Time to Invent* kids have been doing. Choose one of the two options below.

Option A: Do a challenge from Meeting 1

Pick one (or two) of your favorite activities from Meeting 1 (i.e., Treat on the Wall, Paper Clip Challenge, Bubble Challenge, Hands-On Ball Challenge). Go with a favorite, or do one that you didn't have time to do. Each challenge takes about ten minutes, so you'll probably be able to do two. See Meeting 1 for the instructions and the materials lists. The general plan is to:

- explain the challenge to the group
- show them the material(s)
- divide guests into teams (if appropriate for the challenge)
- get people started
- wrap up by having teams quickly share the different ideas they came up with



One option for today is to have your guests do one (or two) of the favorite Meeting 1 challenges.

Option B: Make newspaper clothes

Here's an outline of the roles you and the kids will play in leading the challenge. Even though kids will be facilitating the challenge, you will help get everyone started.

A Introduce the challenge (1 minute)

Tell guests that they will be making an article of clothing or an accessory out of newspaper and tape. You can leave it up to the guests to decide what to make, or depending on the age and ability level, you can mention some possibilities, such as a hat, backpack, dress, umbrella, jewelry, fancy belt, shoes, or a pair of pants, socks, or gloves.

B Present the materials and give the timeframe (1 minute)

Explain that each team will get six sheets of newspaper, three feet of duct tape, and three feet of masking tape. Hold up the materials for everyone to see. Tell guests that they have only about 15 minutes to design and make their pieces, so they should save ambitious designs for another day!

Adjust the challenge level

Easier: Assign a specific, simple article of clothing, like a coat or a poncho.

More Difficult: Add in another material (e.g., a plastic grocery bag and/or cardboard) for guests to use in their designs.

C Form groups (3 minutes)

Divide guests into teams of three or four. (Ideally, have the afterschool staff do this ahead of time.) Introduce club members, and explain that they will work with each team to facilitate the challenge. Hand club members their facilitator sheets, and assign a pair to each team.

D Club members lead guests in a challenge (15 minutes)

Club members facilitate the activity. See the handout for a detailed description of their role. Facilitating means helping guests do the challenge rather than doing it themselves. As needed, club members will help with materials, keep the activity on schedule, anticipate problems and answer questions, and make sure all guests play a role in the activity. If issues arise, a facilitator should ask the mentor or afterschool leader for help.

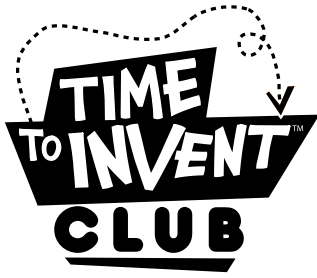
E Share (5 minutes)

After 15 minutes, bring the groups together. Have them put on a fashion show!

4 Celebrate! (15 minutes)

- Invite everyone to enjoy the refreshments.
- Send families this week's text or e-mail message. See page 177.





NEWSPAPER CLOTHES

Use these questions to help your group brainstorm ideas and make the clothing or accessory.

① Brainstorm (2–3 minutes)

- What kinds of clothing or accessories can we make out of newspaper and tape in 15 minutes?
- What problems might we run into as we make clothing out of paper?
- What's the best way to use our limited amount of tape?

② Get ready (1 minute)

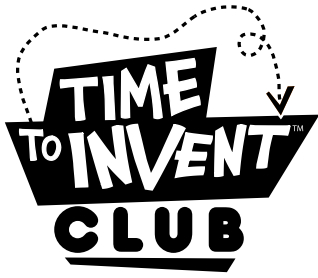
- From all the suggestions, let's choose the item to make.
- Which group member will wear the clothes or accessory? That person will have the pieces fitted to him or her. The others will cut and tape.

③ Design and Build (10 minutes)

- What's not working and why do you think that is?
- What are some ideas you have for solving this problem?

④ Test (2 minutes)

- Dress the person in the custom-made clothes or accessories!



ROPA DE PAPEL PERIÓDICO

Usa estas preguntas para ayudarle al grupo a pensar en ideas y para hacer la ropa o los accesorios.

① Pensar (2 a 3 minutos)

- ¿Qué tipos de ropa o accesorios podemos hacer en 15 minutos usando sólo papel periódico y cinta pegante?
- ¿Qué problemas podríamos ver si usáramos ropa de papel?
- ¿Cuál es la mejor manera de aprovechar una cantidad limitada de cinta pegante?

② Prepararse (1 minuto)

- De todas las sugerencias, hagamos una sola prenda de ropa.
- ¿Quién del grupo se pondrá la ropa o el accesorio? A esa persona se le harán cosas a la medida. Los demás se encargarán de cortar y pegar.

③ Diseñar y construir (10 minutos)

- ¿Qué no funciona y por qué crees que está fallando?
- ¿Qué ideas se te ocurren para resolver este problema?

④ Ensayar (2 minutos)

- Viste a la persona en la ropa o los accesorios hechos por ti.

RAPID RESPONSE

Challenge

Solve two quick invention challenges by thinking fast and finding creative solutions.

Client

Club members will be their own clients

Agenda

- 1 Welcome kids back (if you've had a break), and introduce the *Make It Happen* challenge.
- 2 Pairs of kids choose a "problem strip" that describes a fun problem they need to solve.
- 3 Using the available materials, kids invent solutions for the problem they picked.
- 4 Introduce the *Special Delivery* challenge, where kids send a rice cake through the U.S. mail.
- 5 Each kid makes a protective package for a rice cake and seals it inside a mailing envelope.

What success looks like today

Kids get excited about doing invention challenges and look forward to next week's meeting.

Get ready ahead of time

- Review these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

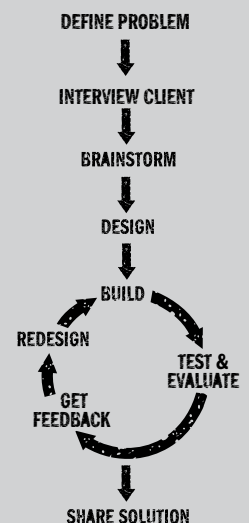
For *Make It Happen*

- Photocopy and cut apart the problem strips (p. 101), and place them in a container.

For *Special Delivery*

- Print an address label with one mentor's address for each kid.
- Plan a time to take the kids' envelopes to the post office, and mail them so you will receive them in time for the next club meeting. Postage averages \$1.50 per envelope.
- Consider mailing yourself an unprotected rice cake, as a basis for comparison.

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

Materials

Group materials for both activities

- ☐ 2 staplers
- ☐ 6 scissors
- ☐ tape (duct, masking, or clear)
- ☐ 3 x 5-inch index cards
- ☐ a stack of newspaper (at least 50 sheets)

Make It Happen (for the group)

NOTE: Kids can invent *Make It Happen* solutions with the materials listed here. To stimulate additional creative solutions, add more materials, such as pipe cleaners, toothbrushes, aluminum foil, leftover materials from other projects, etc.

- ☐ paper clips
- ☐ 25 straws
- ☐ string
- ☐ rubber bands
- ☐ 1 box plastic wrap

Special Delivery (per kid)

- ☐ 2 mini rice cakes (plain or undesirable flavor)
- ☐ 1 sheet of newspaper
- ☐ 2 sheets of copy paper
- ☐ 4 index cards (3 x 5 inches)
- ☐ large, unpadded mailing envelope (8½ x 11 inches)
- ☐ address label with mentor's address



In Make It Happen, kids invent solutions to problems "sent in" by "clients."

Part I: Make It Happen

DESIGN PROCESS STEP

① Define the challenge (5 minutes)

Engage the group

If your club has taken a break between Meetings 8 and 9, welcome kids back and introduce any newcomers. Start off the meeting by asking: Who's ever heard someone mention a problem and then you instantly thought of a way to solve it?

Have a few kids describe problems they solved on the spot. If you have your own story, share it with the kids.

Introduce the challenge

Say: Let's get into the inventing mindset again. All sorts of clients have contacted the *Time to Invent* club with problems to solve. We have quite a backlog. Let's get started!



Tell kids that all sorts of clients have contacted the Time to Invent club with problems to solve.

DESIGN PROCESS STEP

② Brainstorm (5 minutes)

Warm kids up by brainstorming solutions to some of the problems "sent in" by "clients." Choose one (or both) of the sample problems. Read it aloud, and say:

- Raise your hand if anything like this has ever happened to you before.
- What are some ways to solve our client's problem, using simple materials?

SAMPLE PROBLEM 1

I want to protect my cell phone (or MP3 player) from getting wet if it rains and from breaking if it falls. But I lost my cover.

SAMPLE PROBLEM 2

My headphones are always getting tangled in my bag, and I need a way to store them so they don't get all twisted up.

Adjust the challenge level

Easier: There are ten strips—enough for 20 kids. Prior to the meeting, eliminate any that might not work with your group.

More Difficult: Have pairs come up with two solutions to their problem or solve two problems.

DESIGN PROCESS STEP

3 Design and build (15 minutes)

Announce that it's time to start inventing. Tell kids the plan for the next 15 minutes. Pairs will:

- choose a problem strip “sent in” by a “client”
- find a place to work
- look at the materials available
- brainstorm ideas
- design, build, and test solutions

Divide the group into pairs. Have each one pick a problem strip out of a hat. Tell kids to keep their problem a secret—they'll tell the group the problem they solved during the Wrap Up. Make sure kids share materials. Discourage kids from grabbing and stockpiling materials at the start of a meeting, especially if they haven't identified a need for them.



DESIGN PROCESS STEP

4 Wrap up (5 minutes)

Even if pairs aren't finished (there's always more to do!), have the group gather with their inventions. Go around the circle, asking questions, such as:

- What was the problem you solved?
- What types of solutions did you come up with during your brainstorm?
- How does the solution you invented solve the problem?
- I see you're still working on it. How will it work once you finish it?



This problem strip challenged kids to protect their face paint from the rain.

Part II: Special Delivery

DESIGN PROCESS STEP

1 Define the challenge (5 minutes)

Engage the group

Ask: Have you ever opened a package with something fragile inside? What do people use to cushion an item that they're mailing? How does padding protect an item?

Soft, flexible materials, such as paper, foam, and bubble wrap, dampen or distribute the forces caused by a sharp blow or sudden fall. Stiff materials such as a case or box can also shield fragile items.

Introduce the challenge

Read the following scenario aloud:

A second-hand store has started a mail-order business. It often sends small, fragile items, such as watches and jewelry, through the mail. The owner has asked the Time to Invent club to design packaging to protect these delicate items during shipment.

Then say: Your challenge is to design a way to protect a fragile item as it's being shipped. Today we'll be using rice cakes as our test item. Here's the plan:

- I'll give each person a rice cake, a mailing envelope, and some other materials.
- Then you'll make a package to protect your rice cake from getting broken or crushed as it travels through the mail.
- Next, you'll put your rice cake inside your package and slip it into the mailing envelope.
- Finally, I'll take all the envelopes to the post office and mail them to myself. Next time we meet, we'll open the envelopes and see whose rice cake survived the trip.



Kids design a package that protects a rice cake as it travels through the U.S. mail.

2 Brainstorm and design (5 minutes)

Help kids identify different approaches to protecting a fragile item by asking:

- What do you think would happen if you just put a rice cake in an envelope with no protection and sent it through the mail?
It would get broken.
- All these materials—the newspaper, index cards, paper, and tape—are flat. How can you use them to protect a rice cake?
They can be folded, rolled, or twisted.
Making walls and creating air spaces will help protect the rice cake.
- How can you avoid making a package that's too big to fit in the envelope?
Test often.
- What's likely to happen if a package is very hard to open?
You can accidentally break the rice cake when trying to open it.
- Why might our client prefer a lightweight package to a heavier one?
A heavier package costs more to mail.
- What are the features of the ideal packaging?
It protects the rice cake, fits in the envelope, is easy to open, and is lightweight.

Adjust the challenge level

Easier: Use larger envelopes. Also, use a tortilla chip, which is much sturdier.

More Difficult: Reduce the amount or kinds of materials available. Also, use a regular-size rice cake or a potato chip.

3 Build, test, and redesign (15 minutes)

If kids are stuffing an envelope with padding instead of designing a package, ask...

How can you make a package that can protect the rice cake?

Kids can bend, fold, or roll the materials to create walls and air spaces to cushion the rice cake.

If kids are using lots of materials, ask...

How could you use fewer materials and still have lots of protection?

Encourage kids to build packages that are the right size for a single rice cake. Mention that the client doesn't want to pay to ship unnecessary padding.

4 **Wrap up** (10 minutes)

(NOTE: If kids have to leave before finishing, consider letting them finish another time and mailing their packages once they're done.)

Share package designs

Have each kid share his or her design with the group. Ask:

- How will your package protect the rice cake?
- What did you do to help keep your package lightweight?

Address the envelopes

Have each kid:

- put his or her rice cake in its package, insert it into a manila envelope, and seal the envelope
- apply an address label
- write his or her name on the back of the envelope
- put the envelope in a designated spot

(NOTE: On a bulky package, the flap often won't lie flat. Tape it down to avoid problems at the post office.)

Close the session

- Congratulate kids on a successful session and award membership stickers.
- Collect the lanyards.
- Let kids know that next week they'll be part of a rescue squad.
- (Optional) Send families this week's text or e-mail message. See page 177.



Kids can bend, fold, or roll the materials to create walls and air spaces to cushion the rice cake.

Problem Strips

1. Your ball went over a big fence and landed two feet away. You need to get it back, but you can't climb over or walk around the fence.



2. You want to go to sleep. But the light switch is two feet from your bed, and you are too tired to get up and turn the light off.



3. A quarter rolled under a bookcase. You need to get it back, but you can't fit your hand under.



4. You have to carry your lunch money safely until lunchtime, but you have no pockets.



5. You bought a yogurt but have no spoon to eat it with.



6. There's a fly buzzing around your room, and it's really bothering you.



7. You are barefoot and need to get across a hot parking lot to where you left your shoes.



8. You are baking brownies and need to get the hot pan out of the oven, but you don't have oven mitts.



9. You just got your face painted. It looks like it's going to rain, so you need to protect the face paint from getting wet.



10. Your cat is bored with toys that roll across the floor, so you need to come up with a new toy that your cat thinks is fun.

Problemas para resolver

1. La pelota ha salido disparada por sobre una cerca grande y aterrizó a dos pies de distancia. Tienes que recuperarla pero no puedes trepar la cerca ni puedes caminar hasta que termine la cerca para pasar al otro lado.



2. Quieres dormir, pero el interruptor de la luz queda a dos pies de tu cama. Tú estás tan cansado que no tienes ánimo de pararte y apagar la luz.



3. Se te cayó una moneda de 25¢ y rodó debajo de un mueble lleno de libros. Tienes que recuperarla pero la mano no te cabe debajo del mueble.



4. Tienes que guardar el dinero del almuerzo del colegio hasta la hora de comer. Lo que pasa es que no tienes bolsillos!



5. Compraste un yogur pero no tienes cuchara para comértelo.



6. Hay una mosca revoloteando en el cuarto y te está volviendo loco.



7. Estás descalza y tienes que cruzar el pavimento caliente del parqueadero porque dejaste tus zapatos al otro lado.



8. Estás horneando galletas *brownies* y tienes que sacar el molde caliente del horno. Lo que pasa es que no encuentras el toma ollas en ninguna parte.



9. Te acaban de pintar un dibujo en una mejilla. Parece que va a llover así que de alguna manera tienes que protegerte la cara para que no se te moje.



10. Has notado que el gato se aburre con los juguetes que ruedan por el piso. Tienes que inventar algún juguete nuevo que al gato le parezca divertido.

RESCUE 911

Challenge: Invent a tool to get a Ping-Pong® ball out of a tall paper tube.

Client: A baby that's fallen into a well, as described in Step 1

Agenda

- 1 Introduce the challenge, and briefly review the role of a client in the invention process.
- 2 Brainstorm ideas for a tool to "rescue" a Ping-Pong-ball "baby" from a paper-tube "well."
- 3 Build, test, and redesign the rescue tool.
- 4 Review how kids used the design process as they made their rescue tools.

What success looks like today

Kids use materials in a variety of ways and use the design process to build and test their rescue tools.

Get ready ahead of time

- Review these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Assemble the materials, and prepare the cardstock tubes before the meeting. Tape the tubes to a hard, level surface so the hole at the bottom is sealed off.
- Copy the challenge handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

Materials

Per pair

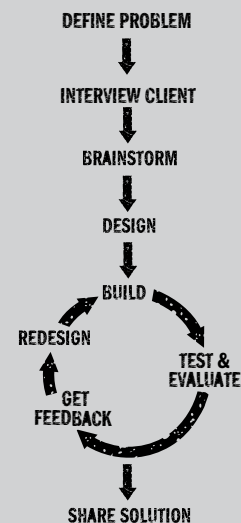
- ☐ 1 Ping-Pong ball
- ☐ 1 6-inch paper tube, 2 inches across (e.g., toilet-paper tube or cardstock that's rolled and taped)

- ☐ 6 pipe cleaners
- ☐ 6 straws
- ☐ 6 craft sticks
- ☐ 6 rubber bands
- ☐ 1 small paper cup (e.g., 3.5 oz.)

For the group

- ☐ string (2 rolls)
- ☐ tape (duct, masking, clear, etc.)
- ☐ 6 scissors

The Design Process



*The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.*

DESIGN PROCESS STEP

① Define the challenge (5 minutes)

Introduce the challenge by reading the kids the following true story:

On October 14, 1987, an 18-month-old girl fell down an abandoned well while she was playing in her aunt's yard. She fell 22 feet, where she became wedged in the narrow shaft. After several tries over more than two days, rescuers finally lifted her to safety.

Ask: What are some challenges to getting a baby out of a deep, narrow hole?
Making the hole bigger risks having rocks and dirt fall onto the girl and hurting or burying her. Pulling her straight out risks injuring her head, neck, and back.

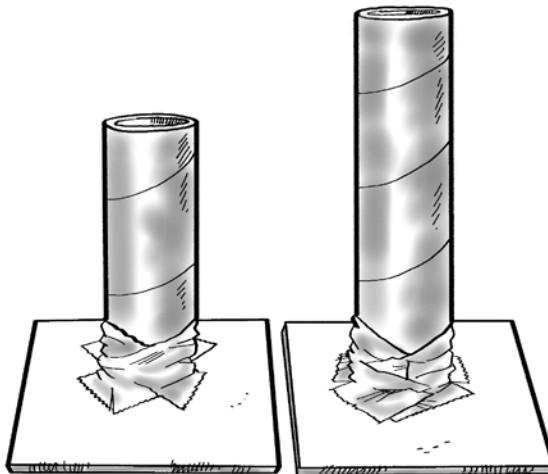
Mention that in 2010, 33 miners were trapped 2,300 feet underground for 69 days in a coal mine in Chile. All of them survived due to many factors, including well-designed rescue equipment. Tell kids that today's challenge is to invent a tool that will remove a baby (i.e., a Ping-Pong ball) from a well (i.e., a paper tube).

DESIGN PROCESS STEP

② Brainstorm and design (10 minutes)

Help kids identify different approaches to making a tool to fish a ball out of a narrow tube by asking:

- What tools and equipment might real rescuers use to get someone out of a deep, narrow hole?
Harness and ropes, crane, sling, shovels, hook, backhoe, etc.
- What are some of the ways to use the materials we have to get the ball out of the tube?
Make a sling. Design a grasping or lifting tool, like a pair of tongs or a suction device.
- What could you do during your rescue to keep from harming the "baby"?
Make sure your rescue tool can lift the ball gently.



③ Build, test, and redesign (35 minutes)

Divide the group into pairs. Distribute the handout and materials. Help kids if the following challenges come up:

If a tool can't grab the ball, ask...

To work best, where should the tip of the tool go and how can you get it to grip the ball better?

Kids may need to make the tool longer or to change the shape of the tip.

Adjust the challenge level

Easier: Make the diameter of the tubes wider. Or, make the tubes shorter.

More Difficult: Make the tubes nine inches tall. Or, eliminate a few of the materials. Finally, consider imposing a time limit for extracting the ball.

If the ball keeps dropping back down, ask...

At what point does the tool drop the ball?

Suggest that the ball may slide off because there's not enough friction between the ball and the tool. Have kids think of a way to increase the friction to make it easier for the tool to grip the ball.



Once kids figure out how to retrieve the ball, have them think if there's a gentler way to do it.



Have kids think of ways to increase the friction between the ball and rescue tool to make it easier to grip the ball.

4 Wrap up (10 minutes)

Reinforce key *Time to Invent* messages

Remind kids that they used the design process when making their rescue tools. Ask:

- Inventors need to test rescue equipment to make sure it works. But you can't test it during a rescue. How can they be confident it will work in an emergency?
Test it under a wide variety of circumstances before they need to use it.
- Would the baby have survived your very first rescue attempt? How did your tool or technique change as you tested your tool?
Most initial rescue attempts would harm the baby. Hopefully, as kids refined their tool and technique, later attempts could rescue the baby more gently.
- Rescues have to be quick and efficient, yet each one is somewhat unique. If you are inventing rescue equipment for a client, what are some important characteristics to keep in mind?
Durability, versatility, whether it's lightweight and portable, etc.

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the rescue tools and lanyards.
- Let kids know that next week they'll invent something to help out an arcade owner.
- (Optional) Tell kids that they can find more details about the rescue by typing "Baby Jessica" into a Web browser's search box.
- (Optional) Send families this week's text or e-mail message. See page 178.

KEEP KIDS INVENTING

There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

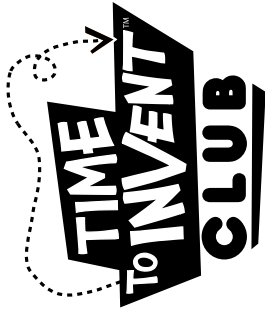
Today

Encourage kids to watch *Design Squad™ Nation* hosts Adam and Judy demo an activity. Watch the videos at: pbskids.org/designsquadnation.

This week

Let kids know they can enter a contest to design a device to help a person with a disability. They can learn about the JETS/AbilityOne National Engineering Design challenge at: jets.org/programs/nedc.

DESIGNsquad
Nation



RESCUE 911

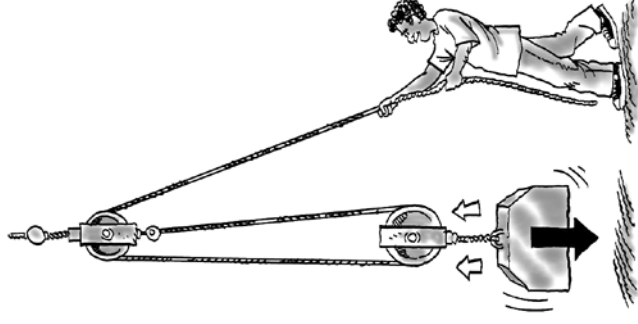
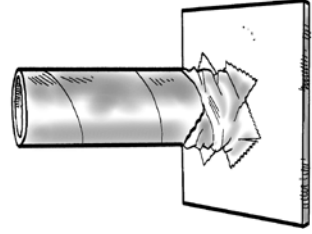
On October 14, 1987, an 18-month-old girl fell down a well shaft while playing in her aunt's yard. She fell 22 feet before becoming wedged in the narrow hole. After several tries, rescuers finally lifted her to safety, 58 hours after she fell in. (To find out more, search "Baby Jessica" on the Web.)

Challenge

Invent a tool to rescue a Ping-Pong® ball "baby" at the bottom of a paper-tube "well."

Materials (per pair)

- 1 Ping-Pong® ball
- 1 paper tube, 6" tall and 2" across
- string
- 6 pipe cleaners
- 6 straws
- 6 craft sticks
- 6 rubber bands
- tape
- 1 small paper cup (e.g., 3.5 oz.)



1 Brainstorm and Design

- What are some different ways to get the ball out of the tube?
- You wouldn't want to hurt the baby, so what are some gentle ways to get the ball out?

2 Build, Test, and Redesign

- **The tool can't grasp the ball.**
What do you want the tip of the tool to do and how can you make it do that?
- **The ball slips off the rescue tool.**
How can you create more friction between the ball and the tool for a more solid grip?

3 Invent Some More

- Design a tool that would work in a taller tube.
- Set a time limit (e.g., one minute) for rescuing the ball.

KEEP INVENTING



Today

Watch *Design Squad™ Nation* hosts Adam and Judy demo an activity. Watch the videos at: pbskids.org/designsquadnation.

This week

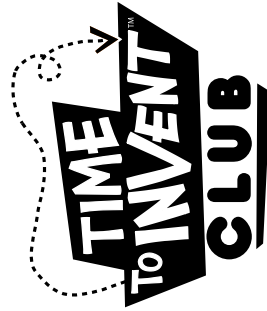
Design a device to help a person with a disability. Learn about the design challenge at: jets.org/programs/nedc.

TIME TO INVENT is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



RESCATE 911

El 14 de octubre de 1987, una niña de 18 meses cayó en un pozo mientras jugaba en el patio de la casa de su tía. Cayó 22 pies antes de quedar atrapada en lo angosto del agujero. Luego de varios intentos de rescate, la sacaron sana y salva 58 horas después de que cayera. (Para ver más detalles, haz una búsqueda de "Baby Jessica" en Internet).

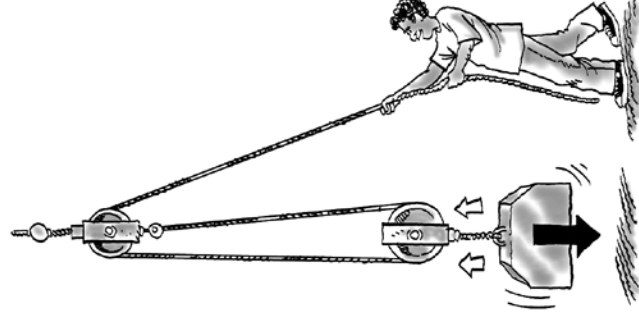
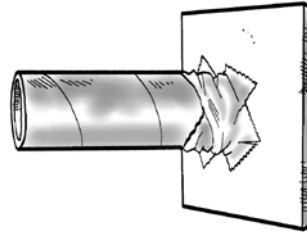
El desafío

Inventa una herramienta que rescate a un "bebé bola de pimpón" del fondo de un "pozo" o tubo de cartón.

Materiales

(para dos personas)

- 1 bola de pimpón
- 1 tubo de cartón, de 6" de alto y 2" de diámetro
- hilo
- 6 limpiapiipas
- 6 pajillas (sorbetes)
- 6 palitos de paleta
- 6 bandas elásticas
- cinta pegante
- 1 vaso de papel chico (de 3.5 onzas)



1 Pensar y diseñar

- ¿Cuáles son algunas maneras diferentes de extraer la bola del tubo?
- No quieres hacerle daño al bebé. ¿Cuáles son algunas maneras suaves de extraer (o sacar) la bola?

2 Construir, ensayar y rediseñar

- **La herramienta no agarra la bola.**
¿Qué quieres que haga la punta de la herramienta?
¿Cómo puedes lograr que haga eso?
- **La bola se suelta de la herramienta.**
¿Cómo puedes crear más fricción entre la bola y la herramienta para que la agarre mejor?

3 Inventar más

- Diseña una herramienta que funcione en un tubo más largo.
- Pon un límite de tiempo (p. ej., un minuto) para rescatar la bola.

SIGUE INVENTANDO

Hoy

Adam y Judy de *Design Squad™* Nation demuestran una actividad. Mira los videos en pbskids.org/designsquadrnation.

Esta semana

Diseña un aparato que le sirva a un discapacitado. Aprende acerca del desafío en jets.org/programs/nedc.



El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention

Pimpón es el nombre en español de la marca registrada Ping-Pong de Sop Services, Inc.



©2011 WEBB Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WEBB.

PINBALL PARTY

Challenge: Build a pinball game that can launch a marble and send it zigzagging down an obstacle course.

Client: Arcade owner, as described in Step 1

Agenda

- 1 Introduce the challenge.
- 2 Brainstorm designs for the three parts of a pinball game: the board, launcher, and obstacle course.
- 3 Invent, build, test, and redesign pinball games.
- 4 Share games, and review how kids used the design process to build their games.

What success looks like today

Kids build a pinball game with an effective launcher and an interesting obstacle course.

Get ready ahead of time

- Review these Leader Notes. To guide you as you run the meeting, make notes about key points, the questions to ask, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

Materials

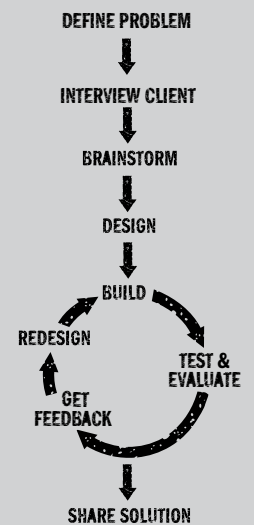
Per kid

- ☐ 1 shallow box (e.g., copier-paper box top, shoebox lid, or pizza box)
- ☐ 1 marble
- ☐ props to support board (e.g., 2 egg carton cups, books, etc.)

For the group

- ☐ 2 boxes of straws
- ☐ 1 bag of rubber bands
- ☐ 12 pieces of chipboard (approx. 5 x 5 inches)
- ☐ 1 box brass fasteners
- ☐ 1 box paper clips
- ☐ 1 pack of index cards
- ☐ 4 hole punchers (optional)
- ☐ 6 scissors
- ☐ tape (duct, masking, or clear)
- ☐ 1 ball of string
- ☐ 1–2 utility knives, a.k.a. box cutters (for leaders only)

The Design Process



*The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.*

1 Define the challenge (5 minutes)

Engage the group

Ask: Who's ever played pinball? How does the game work?

Have a few kids describe how to play pinball or what a pinball machine is. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

Read the following scenario aloud:

A local bowling alley has an arcade with a few pinball machines. People love pinball so much that the owner wants to sell a take-home version of the game. She contacted the Time to Invent club and asked us to design some pinball games for home use.

2 Brainstorm (5 minutes)

Have the following materials readily at hand to illustrate ideas that kids may suggest: the box top, cardboard, 1 marble, 2 brass fasteners, 2 paper clips, rubber band, straw, props, tape, and scissors. Generate ideas for different launchers and obstacle courses by asking:

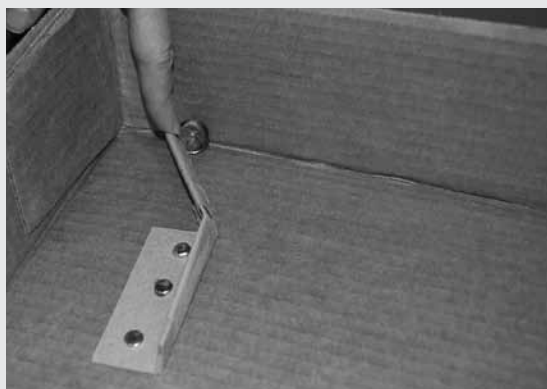
- A pinball game has three parts: a board, a launcher, and an obstacle course. How will you make sure the board is slanted enough so the marble can roll down?
Set the props under one end of the box. Adjust their position to create different angles.
- What are some fun things the marble can do as it rolls down the board?
Kids can make an obstacle course (e.g., tunnels, goal posts, zigzags, etc.), make traps and assign different points for falling into different ones, or put paper targets on the board and see how many they can knock down.
- What are some different ways to launch the marble and send it to the top of the board?
See the photos for different ways to launch a marble. For kids having a hard time conceptualizing a launcher, show them these photos.
- What kinds of obstacles could you make and how would you make them?
Kids can make guide walls from straws, paper, or foil. They can make curves, arches, and tunnels from paper, cups, or foil. They can make elastic bumpers by poking a pair of posts—brass fasteners or paper clips—through the box top and running a rubber band (or an elastic strip made by cutting open a rubber band) between the two posts.



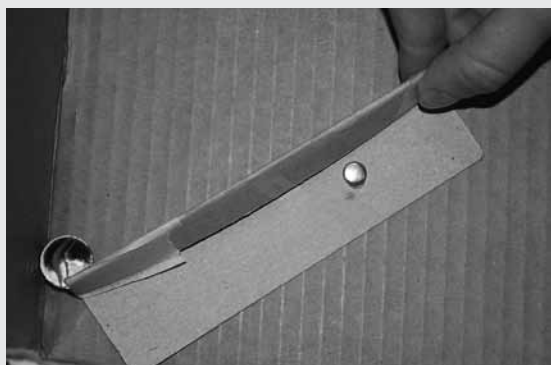
Kids spend their time designing a marble launcher and making an obstacle course.

- How will you make sure the obstacle course works the way you want it to?
Point out that it's best to work from the top down, one obstacle at a time. That's because one obstacle often feeds the marble to the next one. Also remind kids to TEST, TEST, TEST each time they add a new obstacle.
- In what order should you build the board, launcher, or obstacle course?
Kids will find it easiest to start with the board, then the launcher, and finally the obstacles.

Five examples of marble launchers



Spring: Bend back a fixed piece of cardboard. Let go to release the built-up tension.



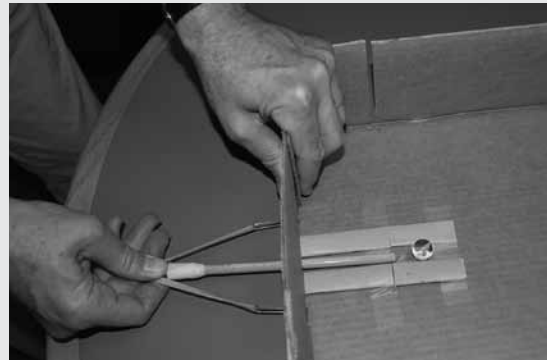
Lever #1: Make a pivoting launcher from folded cardboard and a brass fastener.



Lever #2: By inserting a piece of folded cardboard into a notch in the sidewall, kids can make a pivoting launcher or a flipper to keep the marble in play.



Slingshot: Secure the ends of a thick rubber band with paper clips and pull it back to launch a marble.



Striker: Use a rubber band-powered pencil to knock a waiting marble up the ramp.



For obstacles, kids can make walls, curves, arches, tunnels, and elastic bumpers.



Tell kids that it's best to work from the top down, because one obstacle feeds the marble to the next one. Also remind them to test each time they add an obstacle.

DESIGN PROCESS STEP

③ Design and build (40 minutes)

Kids often have a strong vision for how the launcher should work and what the obstacle course should be. For this reason, the challenge works best as an individual effort. Distribute the handout, and have kids begin designing.

If the marble doesn't have enough energy to make it down the board, ask...

What could you do to make the marble roll down the board faster?

Kids should increase the steepness of the board.

If the launcher can't shoot the marble to the top of the board, ask...

What's keeping the launcher from working the way you want? What are some ways to fix it? *With levers, make sure they rotate freely around the pivot and don't hit the side. To make the end hit the marble more forcefully, have kids position the pivot farther from where the tip hits the marble. With rubber band-powered strikers, make sure the striker slides through the guide hole easily and hits the marble cleanly.*

If an obstacle stops the marble instead of guiding it along, ask...

Why is the marble getting stuck there?

Either the marble doesn't have enough speed when it reaches the obstacle, or the obstacle's angle or shape stops the marble.

Adjust the challenge level

Easier: Rather than making a pinball game, have kids skip the launcher and make a maze game where the player holds the board and tilts it to get the marble to roll through a maze or other obstacle course.

More Difficult: Add flippers to keep the marble in play or a way to return the marble to the launcher after a round is over.

If a kid's design is too ambitious for him or her to actually build, ask...

How can we simplify things?

The simplest launcher is the pivoting lever arm. The simplest obstacle course is a pathway made by taping down a few straws. Also, see the "Easier" suggestion in the Adjust the Challenge Level sidebar.

Tips for cutting cardboard

Kids may need help cutting slots or piercing holes in the box. Because **ONLY** the mentors and afterschool leader have the utility knives (a.k.a. box cutters), adults will cut the cardboard for kids. Tell kids to outline where they want you to cut the cardboard.

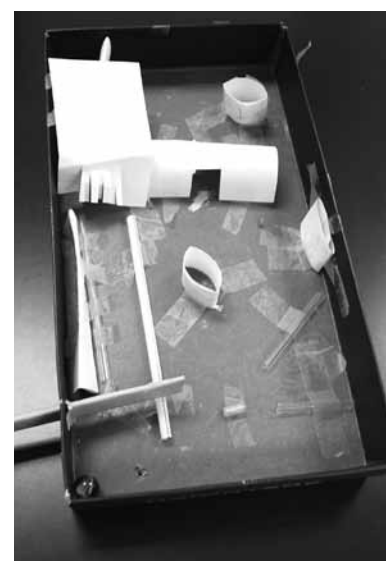
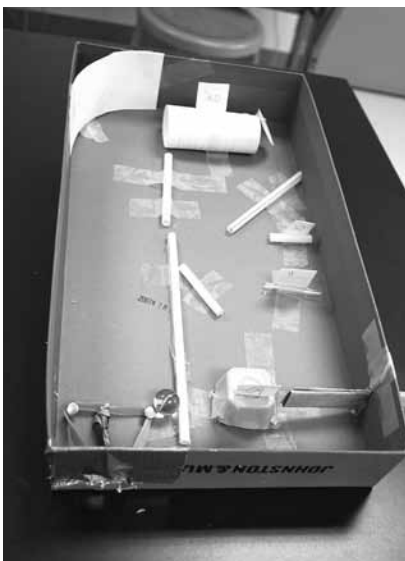
To make the cuts:

- Put some scrap cardboard down to avoid nicking floors or tables.
- Cut using a series of gentle, shallow cuts. This works better than trying to make a cut in a single pass. It also helps to score both sides.
- **ALWAYS** keep the utility knife in your possession. Utility knives do not belong in kids' hands. **REMEMBER:** It's either in your hand or in your pocket.



When cutting cardboard, many gentle, shallow passes produce a far better—and safer—result than a few hard, deep cuts.

Examples of pinball games that kids made



These pinball games show a variety of launchers, runways, arches, tunnels, and walls.

4 Wrap up (10 minutes)

Reinforce key *Time to Invent* messages

Gather the group together. Have each person present his or her game. Ask follow-up questions, such as:

- Tell us about a problem you faced and how you fixed it.
- Testing is one of the design process steps. How did you change things based on what you learned during testing?
- What did the design process steps look like as you made your pinball game? Brainstorm? *(Come up with launcher and obstacle course ideas.)* Design and build? *(Pick one idea and make the game.)* Test? *(See how well it works.)* Redesign? *(Improve the design based on testing results.)* Share? *(Present the game to other club members and, eventually, to the client.)*

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award membership stickers.
- Collect the lanyards.
- Let kids know that next week they'll be designing the next hot fashion.
- (Optional) Send families this week's text or e-mail message. See page 178.

KEEP KIDS INVENTING

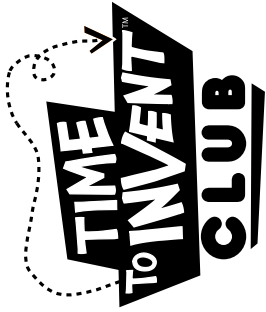
There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

Today

Encourage kids to try out the 15 fun, build-it-yourself projects on the HowToons Web site, presented comic-book style. Find them at: howtoons.com.

This week

Have kids demonstrate their creativity and ingenuity by creating an invention that incorporates rubber bands. Find out more at: rubberbandcontest.org.



PINBALL PARTY

A local arcade has a few pinball machines. People love pinball so much that the owner asked the Time to Invent club to invent a version she can sell to people who want to play at home.

Challenge

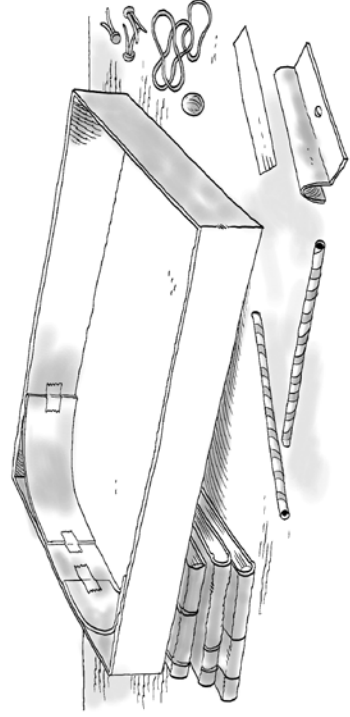
Build a pinball game that can launch a marble and send it zigzagging down an obstacle course.

Materials

- 1 shallow box (box lid or pizza box)
- 1 marble
- 5 straws
- 5 rubber bands
- 6 brass fasteners
- 5 paper clips
- 5 index cards
- thin cardboard
- props for board
- tape
- string

1 Brainstorm and Design

- What are a few ways to launch a marble to the top of the board?
- What are some fun things the marble can do as it rolls down the board?
- What kinds of guides, traps, and bumpers can you make using the materials?



2 Build, Test, and Redesign

- If the launcher can't shoot the marble to the top of the board, find a way to shoot it with greater force or eliminate obstacles that might be in the way.
- If an obstacle stops the marble, figure out why it is getting stuck there.

3 Invent Some More

- Add flippers (or a similar device) to keep a marble in play by sending it back to the top of the board.
- Design an obstacle course that makes the marble take a longer time to get to the bottom.

KEEP INVENTING

Today

Try 15 fun build-it-yourself projects, presented comic-book style. Find them at: howtoons.com.

This week

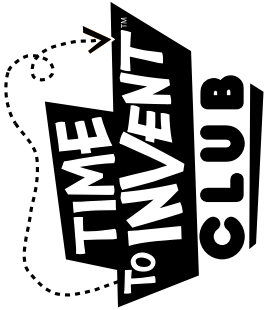
Get creative with rubber bands! Invent something that uses rubber bands and enter it in a contest. Find out more at: rubberbandcontest.org.

TIME TO INVENT is funded by

the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



Fiesta de Pinball

Un centro de maquinitas tiene varias pinball. Las maquinitas tienen tanta acogida que la dueña del centro le pidió al club Time to Invent que diseñara una versión que le pudiera vender a los clientes que quisieran jugar en casa.

El desafío

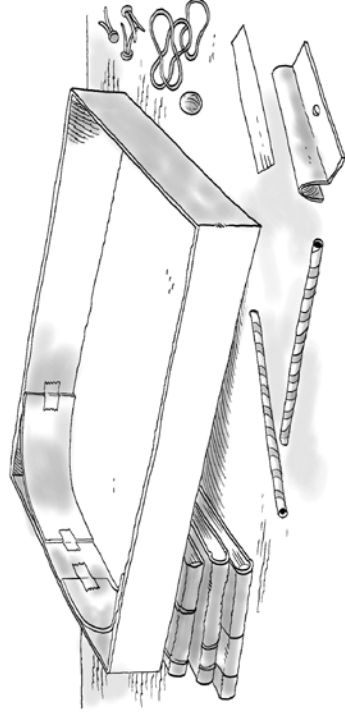
Crear una maquinita pinball que dispare una canica en zigzag por un camino de obstáculos.

Materiales

- 1 caja de poca profundidad (una tapa de caja o una caja de pizza)
- 1 canica
- 5 pajillas (sorbetes)
- 5 bandas elásticas
- 6 sujetadores de latón
- 5 sujetapapeles
- 5 tarjetas de cartulina (de 3"x5")
- cartulina
- utilerías
- cinta pegante
- hilo

1 Pensar y diseñar

- ¿Cuáles son algunas maneras de lanzar una canica a la parte de arriba del tablero de juego?
- ¿Qué cosas divertidas podría hacer la canica a medida que rueda hacia el fondo del tablero de juego?
- ¿Qué tipo de guías, trampas y rebotadores puedes hacer usando los materiales?



2 Construir, ensayar y rediseñar

- Si el lanzador no puede disparar la canica hasta arriba, encuentra una manera de aumentar la fuerza del disparador. O bien, puedes eliminar obstáculos que podrían obstruir el camino.
- Si un obstáculo detiene la canica, averigua por qué se está atascando ahí.

3 Inventar más

- Agrega paletas (o algo parecido) que mantenga la canica en juego, lanzándola otra vez hacia arriba del tablero.
- Diseña un curso de obstáculos que retrase la llegada de la canica al fondo del tablero.

SIGUE INVENTANDO

Hoy

Prueba los 15 proyectos divertidos que se presentan en forma de tiras cómicas en howtoons.com.

Esta semana

Usa tu inventiva con bandas elásticas. Inventa algunos usos y participa en un concurso. Descubre más detalles en rubberbandcontest.org.

El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION. TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.

NEWSPAPER CLOTHES

Challenge

Design and make clothes out of newspaper.

Client

A famous fashion designer, as described in Step 1

Agenda

- 1 Introduce the challenge.
- 2 Brainstorm design ideas for newspaper clothes.
- 3 Build, test, and redesign the clothes.
- 4 Have a fashion show!
- 5 Share results and wrap up.

What success looks like today

Club members work cooperatively in small teams to create a garment made of newspaper. Kids present their designs in a fashion show.

Get ready ahead of time

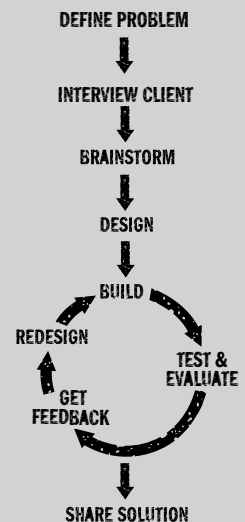
- Review these Leader Notes. To help you run the meeting, make notes about key points, questions to ask kids, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge. This is particularly important for this challenge, since the "client" will need a photo of the kids' outfits since many outfits get destroyed when kids take them off.
- Have lanyards and stickers ready to distribute.

Materials

For the group

- ☐ lots of newspaper (at least 50 sheets)
- ☐ tape
- ☐ scissors

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

① Define the challenge (5 minutes)

Engage the group

Ask: Have any of you ever made clothes or do you know someone who makes his or her own clothes?

Have kids describe clothes they've made or what they've seen other people make. If there's anything in your own personal or professional life that relates to this question, share it with the kids.

Introduce the challenge

Read the following scenario aloud:

A famous fashion designer is interested in starting a line of clothes designed by kids. To have a design considered, you need to create a piece of clothing from newspaper. The designer will look at your design. If it's a finalist, your sample may be used as a pattern to make more clothes like it.

② Brainstorm and design (10 minutes)

- What kinds of clothes can you make out of newspaper?
Pants, shirt, coat, skirt, cape, hat, belt, shoes, etc.
- What are some things that make a clothing design popular?
People like clothes that are good-looking, easy to put on/take off, and have functional elements, such as pockets.
- What are some advantages to working with newspaper?
Newspaper is cheap and easy to modify by cutting away or taping on different parts. It's also green because you're reusing a material.
- What might be a problem when working with newspaper?
It tears easily, may break down after being put on and taken off several times, is not water resistant, etc.



Groups of three work well. One person is the model whom the group fits the clothes to, and the other two cut and tape the pieces onto the model.



Have teams start with a large item, such as a cape, coat, dress, shirt, or pants.

3 Build, test, and redesign (30 minutes)

Tell kids that they need to work in teams of three. All three will conceptualize the design. One person will be the model. The other two will cut and tape the pieces onto the model. The model will walk the runway during the fashion show while the other two team members tell the audience about the garment's design and features.

Kids have lots of strong opinions when it comes to clothes. Be prepared to help teams negotiate roles and design ideas. If there is a lot of contention over roles, assign them yourself with the help of the afterschool leader. Divide kids into groups, distribute the challenge handout, and have them begin.

Adjust the challenge level

Easier: Assign a specific, large, simple article of clothing, like a coat or a poncho.

More Difficult: Add another material (e.g., a plastic grocery bag or cardboard). Make an accessory, such as a hat, backpack, sash, shoes, or gloves.

If the group is having trouble arriving at consensus, ask...

Which designs are doable in the time we have today?

Reassure the team that all the ideas are good. Point out that they can start with one item and then make a second one.

If kids are having trouble deciding what kind of garment to make, ask...

What ideas have you discussed so far?

Rather than starting with something small (e.g., shoes or a hat), have teams start with a large item, such as a cape, coat, dress, shirt, or pants. Consider recommending a garment to make.



Most clothes hang either from the shoulders or waist. Kids should build a base on these areas and then tape on the other pieces.



If kids need something extra to do, have them make an accessory, such as a hat, belt, pocket, or shoes.

If kids are confused about how to start making a design, ask...

What kind of garment is this and what parts does this item of clothing usually have? *Encourage kids to start simply and add special details to an established base. With shirts and coats, the neck and shoulders are the places to establish a base. For pants and skirts, start by wrapping a band of newspaper around the waist. Dresses could start at the shoulders or waist, depending on style.*

If kids finish early, ask...

What else can you make?
Have kids add an accessory, such as a detail like a fancy collar or ruffle, a pocket, or matching hat, belt, or shoes.

DESIGN PROCESS STEP

4 Wrap up (15 minutes)

Share with a fashion show (10 minutes)

After 30 minutes, bring the groups together. Have them put on a fashion show! If kids aren't sure how to talk about their design during the fashion show, ask:

- What are the unique features of your design?
- What would kids like about it?
- When would you wear a garment like this?

With certain designs, kids will have layered, fitted, and taped the newspaper so extravagantly that the model won't be able to take the garment off without destroying it. Reassure them that the client will be happy with a photograph, and then try to extract the model with minimal damage to the garment. For example, cut an opening down the back.



Certain designs will wrap the model so completely that he or she won't be able to take the garment off without destroying it. Reassure kids that the client will be happy with a photograph. Many garments can be saved by cutting an opening down the back.

Reinforce key *Time to Invent* messages

After the fashion show, gather the group and discuss today's challenge.

- How did having a fashion designer as a client affect what you made?
- How did brainstorming help you come up with your design?
- Tell us about a challenge that you faced and how you resolved it.

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award the membership stickers.
- Collect the lanyards and the outfits.
- Let kids know that next week they'll be teaching third graders an electrifying lesson!
- (Optional) Send families this week's text or e-mail message. See page 178.

KEEP KIDS INVENTING

There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

Today

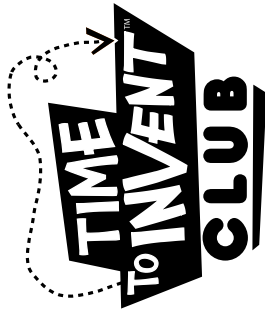
Clothes from duct tape? From candy wrappers? Yes! Tell kids to search the Web for ideas and patterns for making real clothes from unusual materials.

This week

Encourage kids to visit PBS's *SciGirls*' Web site and watch the *SciGirls* team design some clothes. They can also look at some projects posted on the Web site that other kids sent in. Find it at: pbskids.org/scigirls/projects?project=745.



Kids love modeling the clothes they designed.



NEWSPAPER CLOTHES

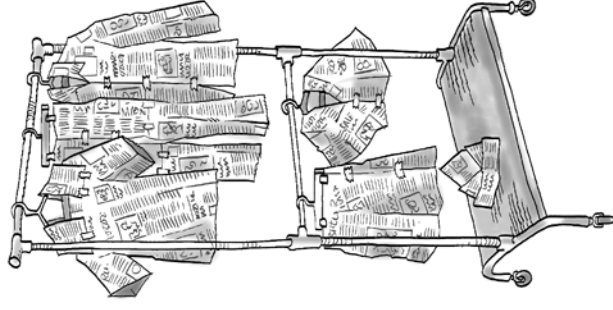
A famous fashion designer wants to start a line of clothes designed by kids. To have a design considered, make a piece of clothing from newspaper. The designer will look at your design. If it's a finalist, your sample may be used as a pattern to make more clothes like it.

Challenge

Design and make clothes and accessories out of newspaper and tape.

Materials

- lots of newspaper
- tape
- scissors



1 Brainstorm and Design

- What kinds of clothes can you make out of newspaper?
- What do people look for in well-designed clothes?
- What problems could you run into making clothing out of paper?

2 Design and Test

All team members choose a design. Then pick a team member to have the clothes fitted to him or her. Other team members will cut and tape.

• So many possibilities! Where to start?

Start with a large item, such as a cape, coat, dress, shirt, or pants.

• How do we actually make something?

Most clothes hang either from the shoulders or waist. Build a base on these areas and then tape on the other pieces.

3 Invent Some More

- Add a detail like a pocket or make an accessory, such as a hat, belt, or shoes.
- Create an ensemble. For example, a hat/jacket/vest to go with a skirt/cape/pants.

KEEP INVENTING

Today

Clothes from duct tape? Candy wrappers? Yes! Search the Web to find ideas and patterns for making real clothes from unusual materials.

This week

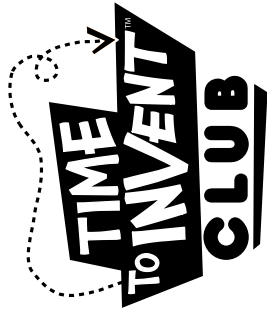
Watch PBS's *SciGirls* team design some clothes and see designs that kids sent in. Find it at: pbskids.org/scigirls/projects?project=745.

TIME TO INVENT is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



ROPA DE PERIÓDICO

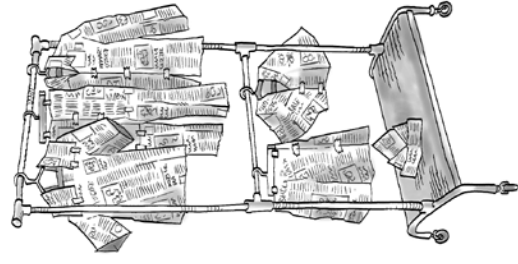
Un diseñador famoso quiere iniciar una línea de ropa creada por niños. Para que tu diseño participe en la competencia, haz una pieza de ropa hecha de papel periódico. El diseñador estudiará tu diseño. Si lo escogen de finalista, utilizarán tu muestra como patrón para hacer más ropa parecida.

El desafío

Diseña y haz ropa y accesorios con papel periódico y cinta pegante.

Materiales

- muchas hojas de papel periódico
- cinta pegante
- tijeras



1 Pensar y diseñar

- ¿Qué modelos de ropa puedes hacer con papel periódico?
- Cuando compran ropa bien diseñada, ¿qué buscan las personas?
- ¿Con qué problemas podrías toparte al crear ropa hecha de papel periódico?

2 Diseñar y probar

Todos en el equipo escogen un diseño. Luego escogen a un compañero o compañera que sea el modelo para probarse la ropa. Los otros cortan y pegan con la cinta.

- **¡Tantas posibilidades! ¿Dónde comenzar?**
Comienza con algo grande, como una capa, un abrigo, un vestido, una camisa o unos pantalones.
- **¿Cuál es el método para hacer algo?**
Casi toda la ropa se tiende sobre los hombros o se ata a la cintura. Crea una base que comience en estas zonas. Luego prosigues a pegar las demás piezas a partir de este inicio.

3 Inventar más

- Agrégale a tu diseño algún detalle tal como un bolsillo. O hazle un accesorio, como un sombrero, correa o calzado.

SIGUE INVENTANDO

Hoy

¿Ropa de cinta pegante plateada? ¿De papel que envuelve caramelos? Busca en Internet ideas y patrones para hacer ropa de verdad con materiales diferentes.

Esta semana

Acude al sitio *SciGirls* de PBS y mira cómo diseñan ropa. La dirección: pbskids.org/scigirls/projects?project=745.

El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT y el logotipo asociado son
marcas registradas de WGBH.

CIRCUIT BOARD

Challenge

Build a game where the player uses a ball to set off a battery-operated buzzer.

Client

Third graders learning about circuits, as described in Step 1

Agenda

- 1 Introduce the challenge.
- 2 Review the basics of electric circuits, if necessary.
- 3 Brainstorm game designs, focusing on building a circuit with a pressure-activated switch.
- 4 Invent, build, and test the Circuit Board games.
- 5 Share results and wrap up.

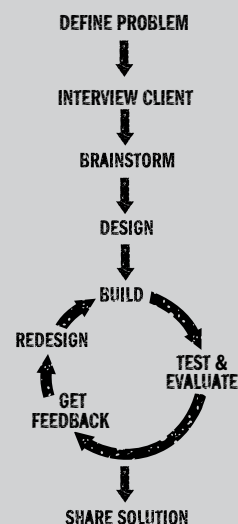
What success looks like today

Kids use their understanding of circuits to design a game with a pressure-activated switch. They are able to talk about how other kids can use their games as a tool for learning about how circuits work.

Get ready ahead of time

- Review these Leader Notes. To guide you as you run the meeting, make notes about key points, the questions to ask, the allotted times, and who's doing what.
- Try the activity before doing it with kids.
- Copy the challenge handout, one per kid.
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

Battery tips

- Use NON-alkaline 9-volt batteries and snap-cap connectors whenever possible. They cost a tenth the price of alkaline ones (about 50 cents). With 9 volts, buzzers roar to life the instant a switch closes, a real advantage over 1.5-volt AA batteries, should the ball close a switch only for an instant.
- Check that the batteries are fresh by testing them with a buzzer.
- The wires on the snap caps often have only a small bit of metal wire exposed. Strip some of the plastic coating to expose more metal.
- The snap cap wires may be too short for kids' designs. Consider providing 10–12 inches of wire to extend one (or both) of the snap cap wires. (Strip the ends first.)
- Don't snap on the caps until you're ready to use the batteries. This prevents the wires from touching, which will run down the battery. When finished, either remove the caps or at least pop the cap off one terminal.
- If inexpensive 9-volt batteries are unavailable, kids can also use expensive 9-volt batteries (about \$3 each) or AA batteries and battery holders (available at electronics stores). For more voltage, they can connect two AA batteries in series.

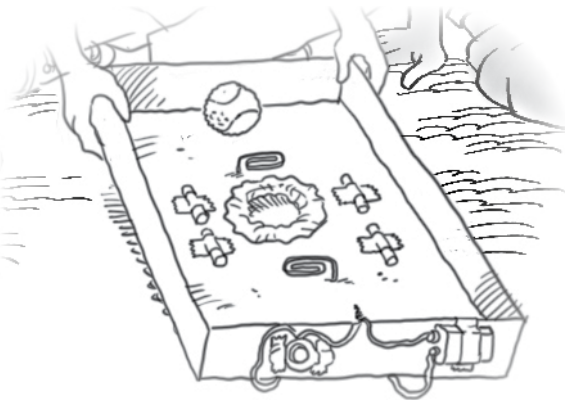
Materials

Per pair

- ☐ 1 buzzer
- ☐ 9-volt battery (NON-alkaline is cheaper) and battery snap-cap connector
- ☐ 1 shallow box (a pizza box, copier-paper box top, or box with trimmed sides works well. (NOTE: A shoebox lid is too small.))
- ☐ 2 lengths of electrical wire (10 to 12 inches long) with stripped ends

For the group

- ☐ tape (electrical, masking, or duct)
- ☐ 6 scissors
- ☐ 3 boxes aluminum foil
- ☐ 6 pencils
- ☐ 12 large (12 oz.) paper cups
- ☐ 50 straws
- ☐ 3 wire strippers
- ☐ 20 paper clips
- ☐ 30 index cards
- ☐ 50 brass fasteners
- ☐ assortment of 12 small balls (e.g., tennis, Ping-Pong®, golf, rubber ball, etc.)



Ping-Pong is a registered trademark of Sop Services, Inc.

1 Define the challenge (5 minutes)

Engage the group

Read the following scenario aloud:

Third graders at a nearby school are learning about electric circuits. But their teacher says that students are having trouble remembering how to connect the parts and get the buzzers to turn on and off. She has asked the Time to Invent club to invent a game to make it easier for her students to understand how circuits work.

Introduce the challenge

Tell kids: Earlier, in the *Buzz Board* activity, you made games where magnets worked as the on-off switch. Today, instead of magnets to close the circuit, you'll use a ball. It will hit one side of the switch and push it into the other side. Once the ball closes the switch, the buzzer will buzz. So your challenge is to build a game where the player uses a ball to set off a buzzer.

What are some examples of switches that you push to make something happen?
Most electrical buttons, such as automatic doors, seat belt sensor, vending machines, elevator buttons, doorbell, computer keyboard, cell phone, calculator, etc.

2 Review circuits (5 minutes)

If your kids did Meeting 7's *Buzz Board* activity, they will be prepared to do this activity and you can skip this review. If some of your kids did not do *Buzz Board*, review the basics. Below is a condensed version of the more detailed introduction to circuits on page 75.

- Hold the battery and buzzer so the ends of the two wires don't touch.
 Ask: What should I do to close the circuit and make the buzzer buzz?
Touch the two ends together.
- With the buzzer buzzing, ask:
 How do I get this thing to stop?
Separate the wires.
- Ask: What happens when there's a gap in a circuit?
With even a tiny gap, electricity won't flow, so the buzzer won't sound.
- Ask: Why do you need to pay attention to the color of the wires?
The buzzer won't work unless the same color wires are connected—red to red or black to black. The crystal inside the buzzer vibrates only when electricity passes through it going in a specific direction.



Today's challenge is for kids to build a game where the player uses a ball to set off a buzzer.

③ Brainstorm game ideas (5–10 minutes)

Today's game is a way to get kids to design a circuit with a pressure-activated switch. Ask kids about how a ball could close a switch. (See the two general approaches described below.) Also ask them what third graders who play their game could learn about circuits.

- **“Push together” switch:** If you wanted a ball to push the two circuit wires together, what could you do?

A ball can bump into or drop onto a switch. The force of the hit or the weight of the ball closes the switch. Remind kids that all the wires have to do is touch. Accept any suggestion where a ball forces the wires together to complete the circuit.

- **“Bridge the gap” switch:** How could you make the buzzer buzz if the ball were covered in foil?
- By wrapping a ball in foil, it becomes a conductor. When it touches against the two ends of the circuit, the ball bridges the gap between two contacts, closing the circuit and buzzing the buzzer.*
- Ask kids, How should you go about planning your game? Should you install the circuit first or plan the game first?
- By planning the game first, kids can choose the location and type of target—a hole, cup, or goal—and can customize their circuit to fit it.*

Adjust the challenge level

Easier: Do one or more of the following before the meeting: (1) Connect the batteries and buzzers. (2) Strip about a half-inch from the end of every wire to ensure foolproof connections. (3) Add wire extensions to each snap cap wire. (4) Tape foil squares onto the ends of the circuit wires.

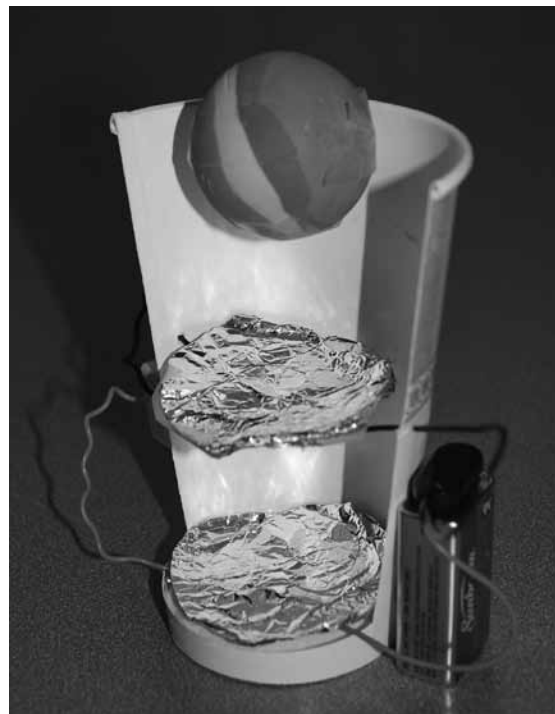
More Difficult: Make a “beginner” and an “advanced” version of their game.



Any design where a ball pushes the wires together will set off the buzzer.



A foil-covered ball can bridge the gap between two contacts, closing the circuit and setting off the buzzer.



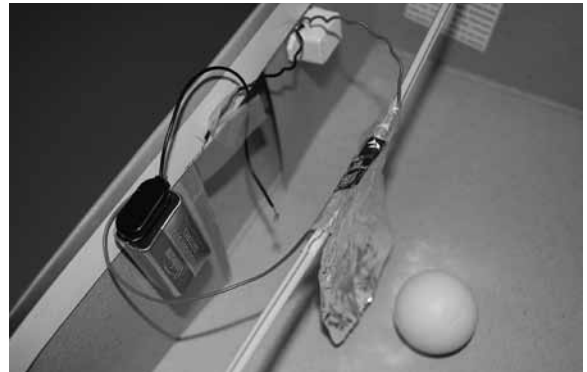
This “cut-away” view shows how kids had a ball drop onto some foil (connected to the black circuit wires) and push it down onto a second piece of foil at the bottom of the cup (connected to the red circuit wires).

4 Build, test, and redesign (40 minutes)

Tell kids that you have wire strippers if they need more wire to be exposed. Divide the group into pairs. Distribute the handout and materials. Here are some issues that may come up during building and strategies for dealing with them.

If the buzzer doesn't buzz when the switch closes, ask...

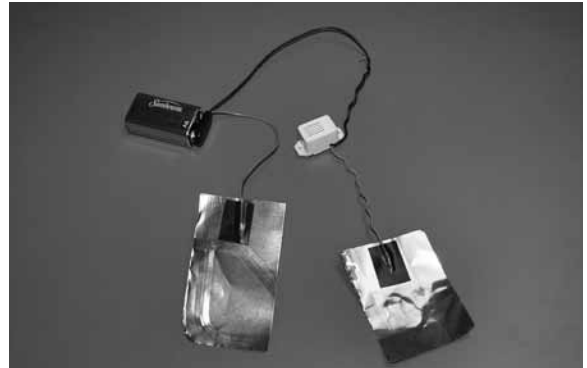
Where might your circuit have a gap?
First make sure that the battery and buzzer wires are connected either black to black or red to red. Then check all wires for loose connections. Finally, make sure there is enough metal wire exposed so that there's good contact between the wire and any foil. If not, strip the wire ends and retape for better contact.



Kids made a target from a sheet of foil attached to one of the circuit wires. When the ball hit the foil, the foil was pushed back onto an exposed piece of wire, which closed the circuit.

If the switch works inconsistently, ask...

How can you improve the contact between the two ends of the circuit when they touch? Would it help if the points of contact were larger?
Have kids attach a paper clip or large piece of foil to the ends of the wires. Also check that the wires and/or foil are at the right height and position to make contact when the ball hits the switch.



Point out that kids can make the contact area larger by taping a piece of foil to the end of a circuit wire.

5 Wrap up (10 minutes)

Reinforce key *Time to Invent* messages

Gather the group. Have each pair present its game. Ask questions, such as:

- What will our client—third graders—learn about circuits by playing your game?
- Did anyone take a similar approach?
- I saw you all testing your designs at every opportunity—just like engineers do. What problems did you face as you built? How did you overcome them?

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award membership stickers.
- Collect the games and lanyards.
- Tell kids that next week they'll be inventing something that a lot of people might want to buy.
- (Optional) Send families this week's text or e-mail message. See page 178.

KEEP KIDS INVENTING

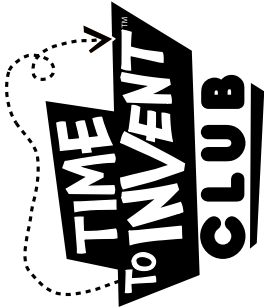
There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. Make a difference by alerting kids to some of the possibilities.

Today

Encourage kids to check out some projects, games, activities, and videos about cool things that engineers do and make. It's at the Discover Engineering site: discoverengineering.org.

This week

Tell kids to apply their problem-solving skills while having fun and being creative. Have them ask a teacher if their school has an Odyssey of the Mind® club. They can also check it out at: odysseyofthemind.com.

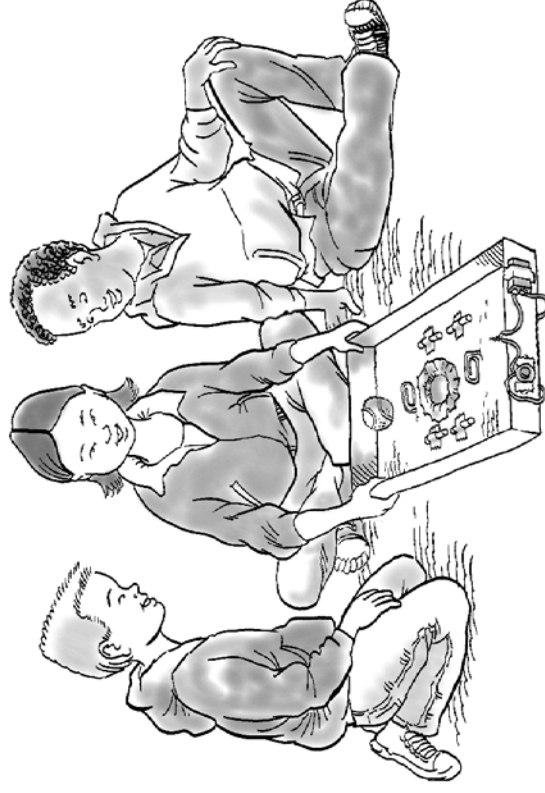


CIRCUIT BOARD

Third graders at a nearby school are learning about electric circuits. But they're having a hard time remembering how to connect the parts. To help them understand how circuits work, their teacher has asked the Time to Invent club to invent a fun way to put a circuit to work.

Challenge

Invent a game where the player uses a ball to set off a buzzer.



Materials

- 1 buzzer
- 9-volt battery and battery cap
- 1 shallow box
- 1 small ball
- 5 straws
- 5 paper clips
- 5 index cards
- 5 brass fasteners
- 2 pieces of electrical wire (10–12 inches long)
- tape
- 1 large (12 oz.) paper cup
- aluminum foil

① Brainstorm and Design

- Will you use a box or a paper cup (or both) for your game?
- How can you use a ball to close the circuit? A ball can push the two wires together, or a foil-covered ball can bridge the gap between the two wires.

② Build, Test, and Redesign

- If the buzzer doesn't buzz when the switch closes, where might the circuit have a gap?
- If a wire needs a bigger end to work well, use foil or paper clips to make switch parts large so that it's easier for them to touch.
- If the switch doesn't work consistently, check to see if the ball hits the switch at the right height. Also close the switch with your fingers to make sure it's working.

③ Invent Some More

- Add a pinball-style launcher for the ball.
- Design two challenge levels: easy and hard.

KEEP INVENTING

Today

Find projects, games, activities, and videos about cool things that engineers do and make at: discoverengineering.org.

This week

Use your problem-solving skills while having fun and being creative. Ask your teacher if your school has an Odyssey of the Mind® club. Also check it out at: odysseyofthemind.com.

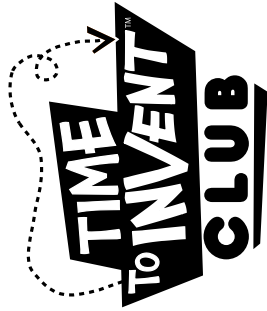
TIME TO INVENT is funded by

the **Lemelson foundation**
improving lives through invention

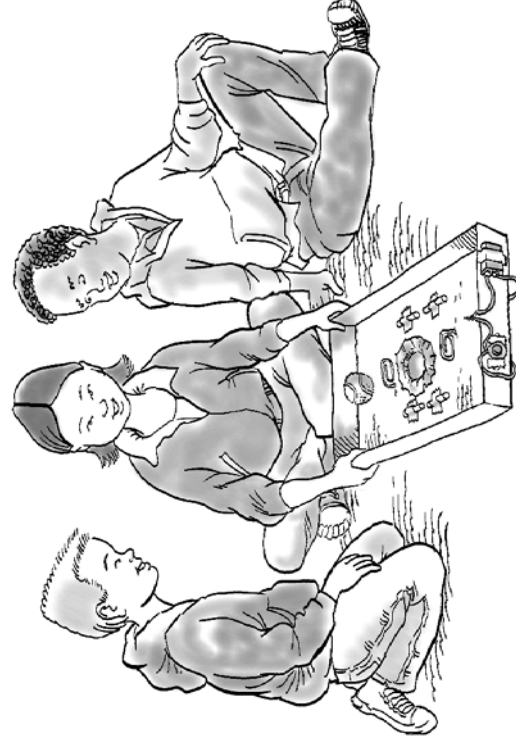
Odyssey of the Mind is a registered trademark of Creative Competitions, Inc.



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



TABLERO DE CIRCUITOS



En una escuela primaria cercana, los niños aprenden sobre los circuitos eléctricos. Pero no todos se acuerdan cómo es que se conectan los elementos. Para ayudarles a entender cómo funcionan los circuitos, la maestra le ha pedido al club Time to Invent que inventen una manera divertida de hacer funcionar un circuito.

El desafío

Inventa un juego en el que se usa una bola para activar el timbre.

1 Pensar y diseñar

- ¿Usarás una caja o una taza de papel (o ambas) en tu juego?
- ¿Cómo puedes usar la bola para cerrar el circuito? La bola puede empujar dos cables para unirlos, o una bola envuelta en papel aluminio puede cerrar la brecha entre los dos cables.

2 Construir, ensayar y rediseñar

- Si el zumbador no suena cuando se cierra el interruptor, ¿dónde podría estar la brecha en el circuito?
- Si un cable necesita un cabo más grande para que funcione bien, usa papel aluminio o sujetapapeles para agrandar partes del interruptor a fin de facilitar el contacto.
- Si el interruptor no funciona siempre, verifica que la bola golpee el interruptor a la altura precisa. También, activa el interruptor con los dedos para confirmar que funciona.

3 Inventar más

- Añádele un lanzador tipo pinball para disparar la bola.
- Diseña dos niveles del desafío: uno fácil y uno difícil.

Materiales

- 1 timbre zumbador
- 1 pila de 9 voltios y tapa de la batería
- 1 caja poco profunda
- 1 bola pequeña
- 5 pajillas (sorbetes)
- 5 sujetapapeles
- 5 tarjetitas de cartulina (de 3 x 5")
- 5 sujetadores de latón
- 2 trozos de cable eléctrico (de 10 a 12" de largo cada uno)
- cinta pegante
- 1 taza de cartón (de 12 onzas)
- papel de aluminio

SIGUE INVENTANDO

Hoy

En discoveringengineering.org encuentra proyectos, juegos, actividades y videos sobre cosas bonitas que hacen los ingenieros.

Esta semana

Usa tus destrezas para resolver problemas al tiempo que te diviertes y eres creativo. Pregúntale a la maestra si en la escuela hay un club de Odyssey of the Mind®. También puedes verlo en: odysseyofthemind.com.

El financiamiento de TIME TO INVENT CLUB proviene de la

the Lemelson foundation
improving lives through invention

Odyssey of the Mind es una marca registrada de Creative Competitions, Inc.

©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.



FUN-RAISING GAMES

Challenge

Invent a collection of games that can be played at a fair, game day, or carnival.

Client

Time to Invent club members

Agenda

- 1 Introduce the challenge by defining the client and talking about games.
- 2 Brainstorm ideas for turning the materials into game components.
- 3 Build, test, and redesign games.
- 4 Wrap up by thinking about how the games will meet the clients' needs.

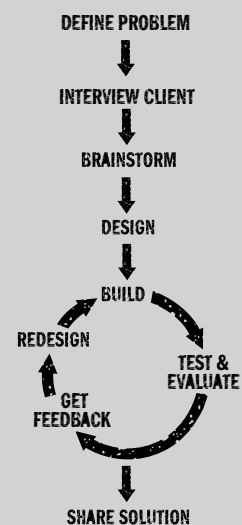
What success looks like today

Kids use the invention process to come up with innovative game ideas that can be marketed to other kids.

Get ready ahead of time

- Review these Leader Notes. To guide you as you run the meeting, make notes about key points, the questions to ask, the allotted times, and who's doing what.
- Copy the handout and the FUN-Raising Game Rules Card, one per kid. Also photocopy the invitation to the Meeting 16 celebration. (See page 149.)
- Write out the names of the "specialty items" on slips of paper. (See page 144.)
- Bring a camera for taking photos of kids doing the challenge.
- Have lanyards and stickers ready to distribute.
- **Looking ahead to Meeting 15:** Meeting 15 depends on having other kids in the afterschool test the club members' games. Contact your afterschool partner to arrange to have a group of 10–12 kids try out the games that club members invent today.
- **Looking ahead to Meeting 16:** Send invitations for the *Time to Invent* celebration to families and interested afterschool staff and colleagues. Secure a room, tables, and chairs at the afterschool.

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

Materials

NOTE: Ask the afterschool leader if there are additional items at the site to use for games.

For the group (six pairs)

- | | |
|---|---|
| <input type="checkbox"/> cardboard (miscellaneous pieces and boxes) | <input type="checkbox"/> 10 pie tins or paper plates |
| <input type="checkbox"/> scissors | <input type="checkbox"/> rubber bands |
| <input type="checkbox"/> 10 paint stirrers | <input type="checkbox"/> 10 large (12 oz.) paper cups |
| <input type="checkbox"/> 1 ball of string | <input type="checkbox"/> duct tape (several rolls) |

Specialty items (Give each pair of kids a different specialty item. For where to buy these items, see page 14.)

- | | |
|--|---|
| <input type="checkbox"/> 5 balloons (9-inch or larger) | <input type="checkbox"/> 2 swimming noodles |
| <input type="checkbox"/> 1 beach ball | <input type="checkbox"/> 2 Ping-Pong® balls |

DESIGN PROCESS STEP

1 Define the challenge (5 minutes)

Introduce the client

Announce that, over the next two meetings, club members will be creating a collection of carnival games. Today, club members will be the clients. But next week, other kids from the afterschool will visit the *Time to Invent* club and play the club members' games.

Discuss the nature of games

Get kids thinking about what a game is and about the widest range of games possible by asking:

- What's the difference between a game and a toy?
Games have rules for playing and a way to win.
- What's one of your favorite playground games and why do you like it?
What ruins a game?
Answers will vary.
- What familiar games might work well at a carnival?
Active games such as darts, miniature golf, kickball, four square, hopscotch, shuffleboard, lawn bowling, hacky sack, horseshoes, etc.
- How might you add a twist to one of these games to make it something new?
One example: For hopscotch, you could redesign the board or have players use a jump rope as they hop.
- Hold up a paint stirrer, and ask kids to brainstorm three ways to use it in a game.
It could be a bat for hitting a ball or balloon, a seesaw-type launcher that flips a ball into the air, a target to be knocked over, etc.

Ping-Pong is a registered trademark of Sop Services, Inc.

② Brainstorm game ideas (10 minutes)

Assign a specialty item to each pair

Pass out the FUN-Raising Games handout, and pair kids up. Randomly assign each pair one of the “specialty items” from the materials list (e.g., draw item names out of a hat). Their challenge is to use the specialty item in their game, along with any of the general materials.

Brainstorm in pairs

To trigger game ideas, have kids spend a minute or two playing with their specialty item—hold it, wave it, flip it, bounce it, and pass it back and forth. Have them brainstorm at least three game ideas. Once they have a few possibilities, have them expand those ideas into games.

③ Build, test, and redesign (40 minutes)

Build

As kids develop their games, ask:

- Is it easy to learn?
- Is the game good for a range of ages and skill levels?
- How long do players have to wait between turns?
- Do all players have an equal chance of winning at the start of the game?
- Will any players be eliminated early or fall too far behind to win?
- Is there a clear winner—few or no ties?
- Can players finish the game in five minutes or less?

Adjust the challenge level

Easier: Have kids take a game they know and use the specialty items to play it.

More Difficult: Have pairs use another specialty item and invent a second game.



Kids get ideas for games by playing with the materials.

Safety check

Emphasize that safety is important, especially when making a product for a client. Kids should check for anything that they think might pose a problem, such as:

- anything sharp or hard
- flying objects that are fast, hard, or otherwise likely to injure someone
- small parts that can be swallowed, especially by young children
- actions that require physical contact (could players hurt each other?)

Test, redesign, and share

Have kids test each other's games. Once the inventors are happy with their game(s), ask them to fill out a FUN-Raising Game Rules Card.

DESIGN PROCESS STEP

4 Wrap up (5 minutes)

Discuss the games

Have kids talk about their games. To get discussion going, ask:

- What was the inspiration for your game?
- Why will someone like playing your game?
- Next week, will it be easy for the kids to get started playing your game?
What will you need to tell them?



Paddle Challenge: Use a paddle to hit a Ping Pong ball into an opponent's cup. Different points for different cups.



Human Ring Toss: Toss a (swimming noodle) ring onto the arm, head, foot, or hand of a human target!

Reinforce key *Time to Invent* messages

Gather the group together. Have kids present their games. Ask follow-up questions, such as:

- How did brainstorming with your partner help you come up with game ideas?
- Did the requirement to use a specific material to create your game make it easier or harder to do?
- How do you think inventors at toy companies use the design process when they make toys?

Close the meeting

- Review the Keep Inventing suggestions on the kids' handout. (Also see below.)
- Congratulate kids on a successful session and award membership stickers.
- Collect the lanyards, games, and game cards.
- Distribute the invitations to the Meeting 16 celebration.
- Remind kids that next week they will need to be good hosts to the other kids who will be testing out their games.
- (Optional) Send families this week's text or e-mail message. See pages 178–179.



Color Dart: Hit balloons with darts made of pipe cleaners. It only counts if you hit a balloon with a dart of the same color.



Beach Ball Trampoline: Partners hold the ends of two swimming noodles between them. They set a beach ball in the middle and bounce it as long as possible.

KEEP KIDS INVENTING

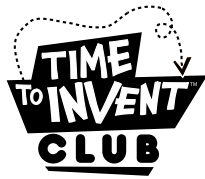
There are lots of ways to keep kids' spirit of inventing alive between meetings. But most kids and families are unaware of what's available. You can make a difference by alerting kids to some of the possibilities.

Today

Tell kids that they can program an online guitar and create their own electronic music on the *Design Squad™ Nation* Web site. They'll also learn about the science of sound while they're there! They can find it at: pbskidsgo.org/designsquad/games/string_thing.

This week

Inspire kids' inner innovator by having them develop creative solutions to real-world challenges. They can learn about it at: techchallenge.thetech.org.



CELEBRATION INVITATION

The Time to Invent club is having a celebration, and you're invited! Come and support your kids and see what they've been working on.

Refreshments will be served!

The Time to Invent celebration will be on:

_____ from _____ to _____
(Date) (Time)

at _____
(Location)

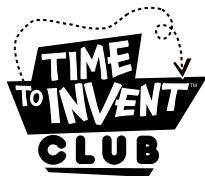
We look forward to seeing you there!

(Co-leaders of the Time to Invent club)

TIME TO INVENT is funded by
the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



Invitación a la Celebración

¡El club Time to Invent realizará una gran celebración, y esta invitación es para ti! Te convidamos a demostrar tu apoyo por los niños y a ver lo que ellos han hecho estas semanas.

Habrà refrigerios para degustar.

La celebración del club Time to Invent será el:

_____ de las _____ a las _____
(Fecha) (Hora)

en _____
(Lugar)

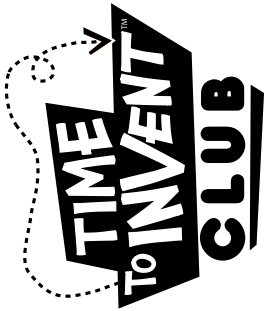
Será un placer contar con tu presencia.

(Co-líderes del club Time to Invent)

El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.



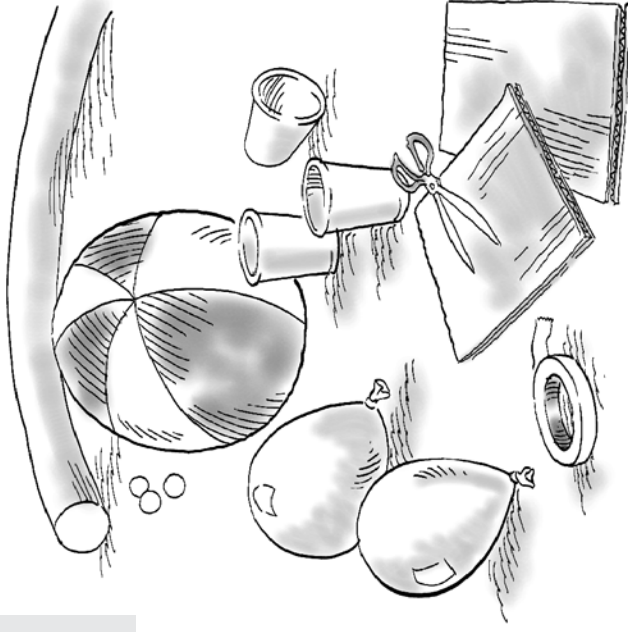
FUN-RAISING GAMES

Challenge: Invent a game that kids would like to play at a carnival. It should be fun, easy to learn, and have a clear way to win.

Client: *Time to Invent* club members

Materials

- Your assigned item
- Whatever else is available
- FUN-Raising Game Rules Card



1 Brainstorm

You and your partner should play around with your assigned item — hold it, flip it, bounce it, and pass it back and forth.

- What are three ways to use it as part of a game?
- How can you use it to add a new twist to a familiar game?

2 Build, Test, and Redesign

- 1 Pick one of your ideas and turn it into a game.
- 2 Here are some things to ask yourselves:
 - Is it easy to learn how to play our game?
 - Is the game good for a range of ages and skill levels?
 - Will any players be eliminated too early or fall too far behind to win?
- 3 When your game is working, have others play it.
- 4 When you're happy with your game, describe it on a FUN-Raising Game Rules Card.

3 Invent Some More

If you have a good idea for another game, go for it!

KEEP INVENTING

Today

Program an online guitar and create your own electronic music. Try it out at pbskids.org/designsquads/games/string_thing.

This week

Develop creative solutions to real-world challenges. Learn about it at techchallenge.thetech.org.

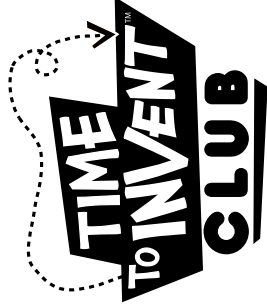
DESIGN squad
Nation

TIME TO INVENT is funded by

the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



DIVERJUEGOS PARA TODOS

El desafío: Inventa un juego que todos quieran jugar en un carnaval. Debe ser divertido, fácil de aprender y que se entienda muy fácilmente cómo se gana.

Cliente: Los miembros del club *Time to Invent*

1 Todos piensan juntos

Tú y tu compañero deben jugar con el artículo que les asignaron (sujetarlo, rebotarlo y pasárselo el uno al otro).

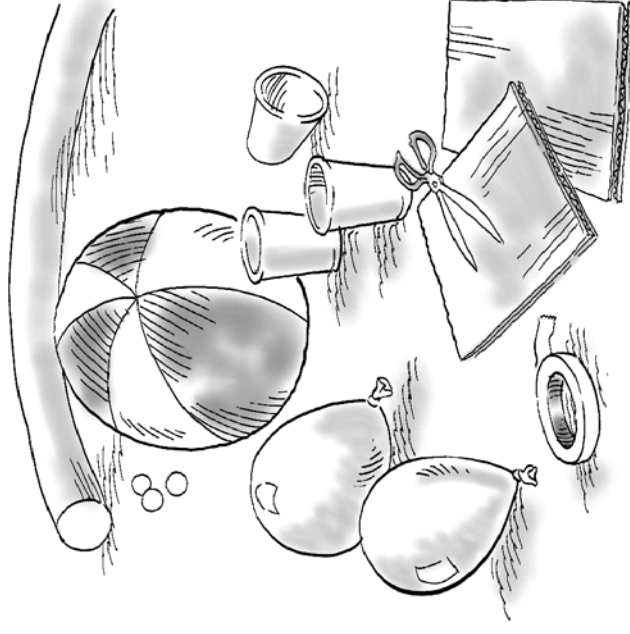
- ¿Cuáles son tres maneras de usarlo como parte de un juego?
- ¿Cómo puedes usarlo para darle una variante nueva a un juego conocido?

2 Construir, ensayar y rediseñar

- 1 He aquí unas cosas que se pueden preguntar:
 - El juego que inventamos, ¿es fácil de aprender?
 - ¿Sirve para diferentes edades y niveles de destreza?
 - ¿Se eliminan o se retrasan muy pronto algunos jugadores y les es imposible o difícil ganar?
- 2 Cuando esté listo el juego, inviten a otros a jugarlo.
- 3 Cuando estén satisfechos con el juego, descríbanlo en una Tarjeta de reglas de los Diverjuegos.

3 Inventar más

Si se te ocurre una idea para otro juego, ¡manos a la obra!



SIGUE INVENTANDO

¡Hoy

Programa una guitarra por internet y crea música electrónica.
Haz la prueba en pbskids.org/designsquads/games/string_thing.

Esta semana

Inventa soluciones creativas para desafíos de la vida real.
Entérate de detalles en techchallenge.thetech.org.

DESIGN.squad.
Nation

El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention

WGBH
©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT y el logotipo asociado son marcas registradas de WGBH.



FUN-Raising Game Rules Card

Game name: _____

Number of players: _____

How you win: _____

How you play: _____

TIME TO INVENT CLUB is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.



FUN-Raising Game Rules Card

Game name: _____

Number of players: _____

How you win: _____

How you play: _____

TIME TO INVENT CLUB is funded by

the **Lemelson foundation**
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.





Tarjeta de reglas de los Diverjuegos

Nombre del juego: _____

Número de jugadores: _____

Cómo se gana: _____

Cómo se juega: _____



Tarjeta de reglas de los Diverjuegos

Nombre del juego: _____

Número de jugadores: _____

Cómo se gana: _____

Cómo se juega: _____



GAME DAY

Challenge

Make sure the games work as intended and that other kids like them.

Client

Other kids in the afterschool program

Agenda

- 1 Test the games with clients and get feedback.
- 2 Refine or invent new games based on the feedback.

What success looks like today

Kids test the games with clients, evaluate the feedback, and refine the games.

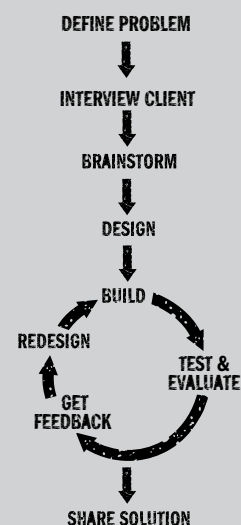
Get ready ahead of time

- Verify the participation of your clients (other kids in the afterschool program) with the afterschool staff—time, place, number of testers, etc.
- Set up games at stations around the testing room, gym, or playground. Each station should have all the game materials, the card with the rules, and pen and paper for notes. (The inventors will also be on hand.)
- If your clients are strong readers, copy the optional FUN-Raising Games Evaluation Sheet for them. The number of copies depends on how many games and testers you will have. The afterschool staff can help you determine students' reading abilities.
- **Looking ahead to Meeting 16:** If you have not yet done so, send celebration invitations to families and interested afterschool staff and colleagues. (See page 149.) Make arrangements with the afterschool leader for getting other kids in the afterschool and families to attend next week's celebration. Also, ask him or her to prepare a few comments about his or her experience in the *Time to Invent* club. (See page 86.) Scan Meeting 16's Leader Notes. If you've taken photos during club meetings, figure out a way to share them (e.g., a slideshow or display of printed photos). Secure a room, tables, and chairs at the afterschool.

Materials

- ☐ club members' games from last meeting
- ☐ assorted materials for on-site repairs
- ☐ blank FUN-Raising Game Rules Cards

The Design Process



The **design process** helps inventors understand a client's needs and devise appropriate solutions. Draw this graphic on the board.

1 Play the games and get client feedback (35 minutes)

Get ready

Remind club members that they need to welcome the kids to their station, brief them on how to play the game, watch the clients playing their game(s), and jot down any observations that can help improve the games. Have club members try to solve any problems that arise, and remind them to ask for a mentor's help if a situation gets beyond what they're comfortable dealing with. Finally, set up stations with the appropriate equipment and game card for each game. Have club members wear their nametags.



Clients—kids in the afterschool program—test the club members' games.

Play away!

Welcome your clients into the testing area, assign pairs of clients to game stations, and let the fun begin. Have them play a game for four or five minutes. As visitors play the game, inventors should look out for:

- parts that don't hold up or don't work right
- confusion about what to do
- playing the game the wrong (or a new) way
- how many attempts it takes players to succeed
- games that take a long time to finish
- any interesting comments or reactions made by the clients



Clients play a game for five minutes and then rotate to a new station.

Debrief the clients

At a signal, clients should stop playing and debrief for about two minutes with the inventors. If you're using the optional evaluation sheets, have clients complete them. Or have inventors ask clients:

- what they especially liked about a game
- what problems they had with the game or the materials
- what ideas they have for improvements



Club members interview the clients about how they liked the games.

Clients rotate to a new station

Have client pairs rotate to the next station. Continue until each pair has visited each game station (or until the 35 minutes run out).

② Refine the games (10 minutes)

Reflect on the feedback

After the testing session ends, review the feedback as a group.

- What did you learn from the testing? Any surprises, good or bad?
- What ideas did you get for redesigning your games?

Refine the games

Allow kids to work on their games and revise their FUN-Raising Game Rules Card.

③ Wrap up (15 minutes)

Reinforce key *Time to Invent* messages

- What kind of feedback did you get from the testers?
- How did testing your games with other kids help you refine your design?
- How have your changes improved the game?

Prepare for Meeting 16

Tell kids that Meeting 16 will be a celebration of the work they have done in the *Time to Invent* club (Meetings 9–15). Other kids from the afterschool program will come to the club to see the many projects that club members have made. There may also be family members present.

Tell club members that, as hosts, they will have the following responsibilities:

Give short presentations of each project. A presenter will describe the challenge, say who the client was, and mention something he or she liked about the activity.

Facilitate a small group of guests in a mini challenge. Club members will lead a quick brainstorm session, assist with materials, keep things on schedule, and deal with issues that come up. The goal is to help their group have fun and be successful. Tell kids that facilitating means helping the guests do the challenge rather than doing it themselves.

To get some Meeting 16 logistics out of the way, do the following:

Form pairs. Divide the group into pairs (or small groups).

Assign each pair a project. Ask who plans to be here next week. Then assign a pair to a particular challenge (Meetings 9–15) that they will present to the group. (NOTE: Kids had multiple challenges in Meeting 9. Use the “problem strip” challenges as needed, either to give more kids a chance to present or to expand the set of inventions to present.)

Close the meeting

- Congratulate kids on a successful session and award the membership stickers.
- If you haven't yet done so, give kids invitations inviting families to the Meeting 16 Celebration. (See page 149.)
- Collect the games, game cards, and lanyards.
- (Optional) Send families this week's text or e-mail message. See page 179.



Kids reflect on the feedback they got and revise their FUN-Raising Games Rules Card.



FUN-Raising Games Evaluation Sheet

Name of this game: _____

Please circle your answers.

- 1 This game was: too hard just right too easy
- 2 Did you have fun? 😊 😐 ☹️
- 3 Was it easy to learn how to play? yes sort of no
- 4 Would you want to play this game again? yes maybe no
- 5 What's one way to make it better? _____

TIME TO INVENT CLUB is funded by

the **Lemelson foundation**
improving lives through invention

 ©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.



FUN-Raising Games Evaluation Sheet

Name of this game: _____

Please circle your answers.

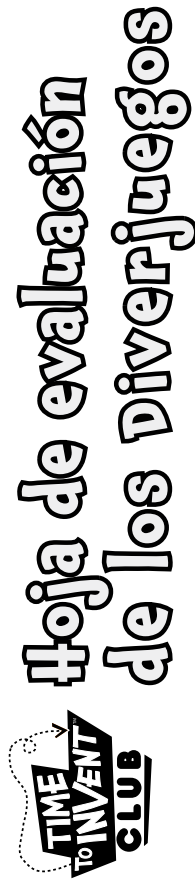
- 1 This game was: too hard just right too easy
- 2 Did you have fun? 😊 😐 ☹️
- 3 Was it easy to learn how to play? yes sort of no
- 4 Would you want to play this game again? yes maybe no
- 5 What's one way to make it better? _____

TIME TO INVENT CLUB is funded by

the **Lemelson foundation**
improving lives through invention

 ©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.

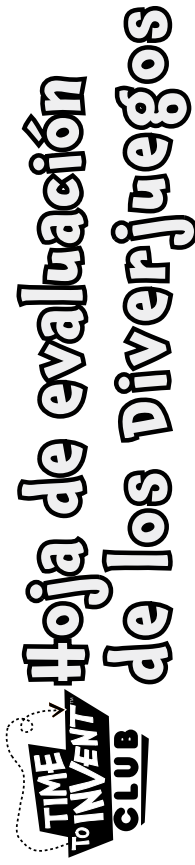




Nombre de este juego: _____

Ponle un círculo a la opción que quieres marcar.

- | | | | | |
|---|--------------------------------------|-------------|-------------|-----------|
| 1 | Este juego me pareció: | muy difícil | muy bueno | muy fácil |
| 2 | ¿Te divertiste? | | | |
| 3 | ¿Es fácil aprender a jugarlo? | sí | más o menos | no |
| 4 | ¿Quieres jugar este juego otra vez? | sí | quizás | no |
| 5 | ¿Qué se podría hacer para mejorarlo? | _____ | | |



Nombre de este juego: _____

Ponle un círculo a la opción que quieres marcar.

- | | | | | |
|---|--------------------------------------|-------------|-------------|-----------|
| 1 | Este juego me pareció: | muy difícil | muy bueno | muy fácil |
| 2 | ¿Te divertiste? | | | |
| 3 | ¿Es fácil aprender a jugarlo? | sí | más o menos | no |
| 4 | ¿Quieres jugar este juego otra vez? | sí | quizás | no |
| 5 | ¿Qué se podría hacer para mejorarlo? | _____ | | |



FINALE CELEBRATION

Overview

Have fun and share the club with others.

Client

Invited guests: Family members and other kids and leaders in the afterschool

Agenda

- 1 Welcome guests, introduce leaders, and describe the club.
- 2 Present kids' inventions.
- 3 Do a quick invention challenge with the guests.
- 4 Party!

What success looks like today

Club members present their work effectively, and they successfully lead guests in a challenge. Everyone leaves having had fun and with a good impression of the *Time to Invent* club.

Get ready ahead of time

- Confirm with your afterschool partner how many guests will attend the celebration and that guests know which room to go to.
- Make sure club members are ready to present the projects.
- Get the invention challenge materials ready for quick distribution.
- Copy the Ways to Keep Inventing handout, one per kid. (See Appendix, page 181 (English), page 183 (Spanish).
- Finalize the display of printed photos or slideshow.
- Arrange the tables and chairs in the room, and set out the drinks and snacks.
- Set up stations around the room to display kids' inventions. Include several examples of each challenge, and be sure every club member has something displayed. If stations don't work in your space, place the inventions on a central table.

Materials for the “Quick-Build” challenge

- | | |
|---|---|
| <input type="checkbox"/> 1 sheet of copy paper per centerpiece (colored paper, if possible) | <input type="checkbox"/> 1 ruler for the mentor |
| <input type="checkbox"/> clear tape | <input type="checkbox"/> scrap cardboard (optional) |
| <input type="checkbox"/> scissors | <input type="checkbox"/> prizes (optional) |

① Welcome (5 minutes)

The afterschool program leader should welcome guests to this special *Time to Invent* event. The kids and families know the program staff, so this is an effective way to establish the connection between the afterschool program and the *Time to Invent* club. If there are many families visiting the club for the first time, see page 86 for ideas on introducing them to the club and mentors.

After welcoming and seating guests, introduce yourself and the other leaders and briefly outline the agenda. Let guests know that *Time to Invent* is an invention club where kids tackle fun challenges and come up with creative solutions. Explain that the club members have put together a special presentation for their guests. Tell the guests that today is about having fun and checking out some of the things that club members have created over the course of the meetings.

② Showcase inventions (15 minutes)

Have club members give a one-minute presentation of each of the Meeting 9–15 projects. Ask them to describe the challenge, the client for each challenge, and what they built. If presenters get stuck, here are some helpful prompts:

- Tell us what you liked about this challenge.
- Tell us who the client for this invention was.
- Tell us about some of the different solutions the group came up with.
- Tell us about the biggest problem you overcame.



The celebration is a time for people to learn about the club by hearing club members talk about the challenges they tackled.

③ Do an invention challenge (10 minutes)

Have kids surprise guests by announcing that it's time for everyone to do an invention challenge! This is an opportunity for kids to be the “inventor in charge” and demonstrate their understanding of the invention process. They should explain the:

- **client:** everyone here
- **problem:** no centerpieces for the tables
- **challenge:** build the tallest possible centerpiece from one sheet of paper

Divide guests into small groups while kids quickly set out the materials at each workspace:

- 1 sheet of 8½ x 11-inch paper
- 1 foot of clear tape
- scissors

Tell the teams they have three minutes to build their centerpiece towers. Measure the heights of the centerpieces and, if you choose to, award a prize for the highest one.

④ Recognition and awards (15 minutes)

Call each inventor up front to receive:

- the final sticker for their membership card
- a Certificate of Achievement
- praise on a personal achievement
- a round of applause

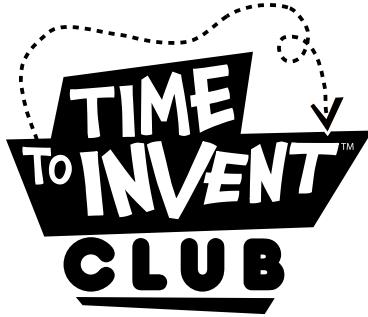


Positive STEM experiences in elementary and middle school are a significant factor in steering kids into science- and technology-related career paths.

⑤ Celebrate! (15 minutes)

Finally, thank the leaders and site hosts for a successful program. Hand out the Ways to Keep Inventing handout, telling kids and families that it lists invention-related programs, contests, and Web sites to keep kids inventing. Invite everyone to enjoy the snacks, play the games, and check out the inventions on display.





Dear family,

Your child has enrolled in the *Time to Invent*[™] club at the afterschool program. Each week, the club members will be designing cool inventions that solve problems and make the world a better place.

Every week, we'd like to send you questions to help you talk with your child about what happened during the club. Here's an example: *How did you make your tower hold a tennis ball?* Your support and interest in what happens means a lot and will contribute to your child's success.

If you would like us to send you these questions each week, please provide your contact information below. Tell us if you'd prefer to get an e-mail or text message.

Return this form to: _____

Thanks!

Your name: _____

Your child's name: _____

I would prefer to receive: ☐ e-mails ☐ text messages

e-mail address*: _____

cell phone number **: _____

Which language would you prefer? ☐ English ☐ Spanish

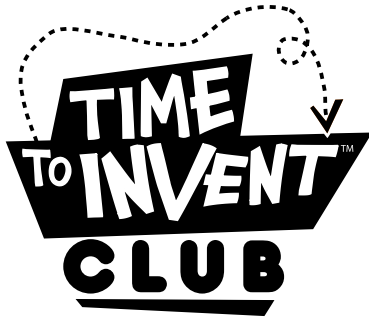
* We will use your information only for messages related to the *Time to Invent* club and will not share it.

** Standard text rates apply.

TIME TO INVENT is funded by
the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.



Apreciada familia:

Su niño está inscrito en el club *Time to Invent*TM que forma parte del programa que se lleva a cabo después de horas escolares. Cada semana los niños diseñarán inventos divertidos que resolverán problemas y que harán del mundo un mejor lugar para vivir.

Cada semana le enviaremos preguntas que le ayudarán a orientar el diálogo con el niño acerca de lo que se hizo esa semana en el club. Por ejemplo: *Explicame cómo hicieron la torre que sujeta una bola de tenis*. El apoyo y el interés que usted le demuestre al niño significa mucho y aportará a los éxitos que vivirá el niño.

Si desea que le enviemos las preguntas cada semana, sírvase darnos a continuación sus datos de contacto. Indíquenos también si desea recibir la información en su computadora (mensaje electrónico) o en su teléfono (mensaje de texto).

Devuelva este formulario a: _____

Gracias.

Su nombre: _____

El nombre del niño: _____

Prefiero recibir: ☐ mensajes electrónicos ☐ mensajes de texto

No. de celular*: _____

Dirección electrónica**: _____

¿En qué idioma prefiere recibirlos? ☐ Inglés ☐ Español

* No usaremos sus datos de contacto para ningún mensaje que no se relacione con el club Time to Invent.

** Se aplicarán las tarifas de texto vigente

Text and E-mail Messages

The support of family members has been shown to be a significant factor in keeping kids involved in STEM. The text messages below serve as conversation starters that help families talk with their club member about what he or she did during the club meeting. Create a “group” on your phone or computer, and each week, send families a message so they can stay up to date with what’s happening and support all you are doing. You can also photocopy individual messages or the full set and send hard copies home with the kids.

Use the “Dear family” letter (page 171 English and page 173 Spanish) to let families know about the club and about the texting/e-mail option. The letter also gives you a way to collect families’ contact information.

Welcome

Subject: Welcome to the *Time to Invent* club!

We’re excited your child signed up for the Time to Invent club! Once it starts, we’ll send weekly questions you can ask your child about what happened that day.

Subject: Bienvenido al club *Time to Invent*

Qué lindo tener a su niño en el club Time to Invent! Apenas empiece, le enviaremos preguntas semanales para que dialogue con el niño sobre lo que se hizo ese día.

Before the club starts

Subject: *Time to Invent* starts soon!

What do you think you’ll do in the Time to Invent club? What does it mean to invent something? What do you think an inventor does?

Subject: La pregunta de hoy sobre el club

¿Qué crees que harán en la siguiente reunión del club Time to Invent? ¿Qué significa inventar algo? ¿Qué crees tú que hace un inventor?

After Week 1: Club Launch

Subject: Today’s club question

What were the leaders like in the Time to Invent club? Were you given any unusual or surprising challenges? How did you solve the challenges?

Subject: La pregunta de hoy sobre el club

¿Qué tal te parecieron los líderes en el club Time to Invent? ¿Te dieron desafíos extraños o sorprendentes? ¿Cómo resolviste los desafíos?

After Week 2: Trophy Tower

Subject: Today's club question

Today we made a tower out of straws. Ask, How did you make your tower hold a tennis ball? What was the hardest part of making it stand up?

Subject: La pregunta de hoy sobre el club

Hoy hicimos una torre con pajitas. Pregunte: ¿Cómo lograste que tu torre sujetara una bola de tenis? ¿Qué fue lo más difícil para que permaneciera parada?

After Week 3: Hit the Target

Subject: Today's club question

Today we made foot-powered ball launchers. Ask, How high did your launcher shoot the ball? How did you make it? Did you play other games with it?

Subject: La pregunta de hoy sobre el club

Hoy hicimos lanzabolas impulsados por los pies. Pregunte: ¿Qué tan alto lanzo la bola tu lanzador? ¿Cómo lo hiciste? ¿Lo usaron para jugar otros juegos?

After Week 4: Paper Bridge—Paper Chair

Subject: Today's club question

We made paper stronger by folding it. Ask, How did you make paper strong? How many pennies did your bridge hold? What kinds of chair models did you make?

Subject: La pregunta de hoy sobre el club

Hoy plegamos papel para darle más fuerza. Pregunte: ¿cómo hiciste el papel más fuerte? ¿Cuántas monedas sujetó tu puente? ¿Qué modelos de silla hiciste tú?

After Week 5: Green Loungers

Subject: Today's club question

Today we built chairs from cardboard. Ask, How can you make a strong chair out of cardboard? How does your chair hold you up without collapsing?

Subject: La pregunta de hoy sobre el club

Hoy hicimos sillas de cartón. Pregunte: ¿Cómo se puede fortalecer una silla de cartón? ¿Cómo hace la silla en la que estás sentado para sujetarte?

After Week 6: Green Loungers (Message 1 of 2)

Subject: Today's club question

Today we finished the cardboard chairs. Ask, What special features did you add to your chair? Did you make the back adjustable or add a cup holder?

Subject: La pregunta de hoy sobre el club

Hoy terminamos las sillas de cartón. Pregunte: ¿Qué cosas especiales le pusiste a tu silla? ¿Le pusiste espaldar ajustable o le agregaste un portavasos?

After Week 6: Invitation to Show & Tell Celebration (Message 2 of 2)

Subject: Today's club question

You are invited to a Time to Invent club celebration on (day), (time), at (location). Food and beverages served. We hope to see you!

Subject: La pregunta de hoy sobre el club

Les invitamos a la celebración del club Time to Invent el (day), (time), en (location). Se servirán refrigerios. ¿Contamos contigo?

After Week 7: Buzz Board

Subject: Today's club question

Today, we made electric circuit games. How do you play the game you made today? How did you make the buzzer go on and off?

Subject: La pregunta de hoy sobre el club

En los juegos de hoy usamos circuitos eléctricos. ¿Cómo se juega el juego que hiciste hoy? ¿Cómo hiciste que sonara y se apagara el timbre?

After Week 8: Celebration

Subject: Today's club question

The Time to Invent club was a success! We hope you enjoyed discussing it with your child. We'll start up again on (day) at (time). Happy New Year!

Subject: La pregunta de hoy sobre el club

El club Time to Invent fue un éxito. Ojalá haya disfrutado los diálogos con el niño. Comenzaremos de nuevo el (day) a las (time). ¡Feliz año nuevo!

Welcome back / Before the club starts

Subject: Welcome (back) to the *Time to Invent* club!

We're excited your child is returning to the Time to Invent club! We'll send weekly questions you can ask your child about what happened that day.

Subject: Bienvenido de regreso al club *Time to Invent*.

Estamos muy contentos de que el niño regrese al club Time to Invent. Cada semana le enviaremos preguntas para que usted le pregunte qué hizo ese día.

After Week 9: Rapid Response

Subject: Today's club question

Were you given any fun challenges to solve on the spot today? How did you solve them? Do you think your rice cake will survive in the mail?

Subject: La pregunta del día sobre el club

¿Hoy te presentaron desafíos para resolver en un instante? ¿Cómo los resolviste? ¿Crees que la tortilla sobrevivirá en el correo?

After Week 10: Rescue 911

Subject: Today's club question

Today we made a tool to extract a Ping-Pong ball "baby" from a "well." Ask, How did you get your tool to work? What materials did you use?

Subject: La pregunta del día sobre el club

Hoy hicimos una herramienta para sacar una pelota de ping pong "bebé" de un "pozo".

Pregunte: ¿cómo hiciste funcionar tu herramienta? ¿Qué materiales usaste?

After Week 11: Pinball Party

Subject: Today's club question

Today we constructed Pinball-like games. Ask, How did you launch your marble? What kinds of obstacles did you build?

Subject: La pregunta del día sobre el club

Hoy hicimos juegos como los de maquinitas. Pregunte: ¿cómo lanzaste tu canica? ¿Qué tipo de obstáculos armaste?

After Week 12: Newspaper Clothes

Subject: Today's club question

Today we made clothing out of newspaper. Ask, What challenges did you run into constructing clothes with paper? How could your clothing be used?

Subject: La pregunta del día sobre el club

Hoy hicimos ropa de papel periódico. Pregunte: ¿con que desafíos te topaste al hacer ropa de papel periódico? ¿Cómo podrías utilizar tu ropa?

After Week 13: Circuit Board

Subject: Today's club question

Today we invented a game that sets off a buzzer. Ask, How do you play the game you made today? How did you make the buzzer go on and off?

Subject: La pregunta del día sobre el club

Hoy nos inventamos un juego que prende un zumbador. Pregunte: ¿cómo se juega el juego que hiciste hoy? ¿Cómo lograste que se prendiera y apagara el zumbador?

After Week 14: FUN-Raising Games (Message 1 of 2)

Subject: Today's club question

Today we invented playground games. Ask, What kinds of games did you invent? What special material did you use?

Subject: La pregunta del día sobre el club

Hoy inventamos juegos de parque infantil. Pregunte: ¿qué tipos de juegos te inventaste tú? ¿Cuál de los artículos fue tu especialidad?

After Week 14: Invitation to Finale Celebration (Message 2 of 2)

Subject: Today's club question

You are invited to a Time to Invent club celebration on (day), (time), at (location). Food and beverages served. We hope to see you!

Subject: La pregunta del día sobre el club

Te invitamos a la celebración del club Time to Invent el (day), (time), en (location). Habrá comida y bebidas. ¿Contamos contigo?

After Week 15: Game Day

Subject: Today's club question

Today, we tested our playground games with other kids. Ask, Did the kids have fun playing the game you invented? What changes did you make to your game?

Subject: La pregunta del día sobre el club

Hoy probamos nuestros juegos de parque con otros niños. Pregunte: ¿pasaron rico tus clientes con tu juego? ¿Qué tuviste que cambiar en tu juego?

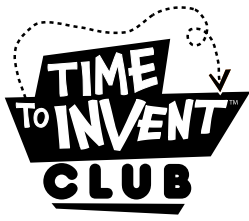
After Week 16: Finale Celebration

Subject: Today's club question

The Time to Invent club was a success! We hope you enjoyed discussing it with your child.

Subject: La pregunta del día sobre el club

El club Time to Invent ¡fue todo un éxito! Esperamos que haya gozado de su interacción con el niño.



Ways to Keep Inventing

PROGRAMS

Have fun by combining science, engineering, and inventing.

First LEGO League (usfirst.org/community/fll)

In this robotics program, kids work together to solve a real-world challenge and build a robot.

Future City Competition (futurecity.org)

Team competition sponsored by a teacher where kids in grades 6–8 work with a mentor to design a city of the future.

Odyssey of the Mind (odysseyofthemind.com)

This competition-style educational program provides problem-solving opportunities for students of all ages.

Science Olympiad (soinc.org)

This competition-style science tournament is for teams of students in grades 6–12. It offers the Elementary Science Olympiad for kids in grades K–5.

If you're involved with your local Girl Scouts or Boys Scouts organizations, check out their invention resources:

Girl Scouts (girlscouts.org/program/program_opportunities/science)

Girl Scouts can participate in a variety of programs with a focus on STEM and robotics.

Boy Scouts (scouting.org/sitecore/content/Home/BoyScouts/AdvancementandAwards/MeritBadges/mb-inventing.aspx)

Boy Scouts can earn their Inventing merit badge by finding creative solutions to real-world problems.

CONTESTS

Participate in these fun invention competitions.

BKFK (By Kids for Kids) (bkfk.com)

BKFK hosts fun invention challenges where kids can compete for prizes.

The Christopher Columbus Awards (christophercolumbusawards.com)

This national contest challenges middle school students to identify a problem in their community and create an innovative solution.

SUMMER CAMPS

Explore new opportunities at these summer camps.

Camp Invention (invent.org/camp)

In this summer day-camp program, kids do fun invention activities that build creative problem-solving and critical-thinking skills.

American Society of Mechanical Engineers (asme.org/Communities/Students/K12/Camps.cfm)

Use this comprehensive list (organized by state) to find engineering camps for kids.

ONLINE RESOURCES/PROJECTS

Visit these great Web sites to find activities and learn more about invention.

Design Squad Nation (pbskidsgo.org/designsquadnation)

This online resource brings engineering to life and engages kids with episodes, games, 40 hands-on challenges, and much more. Visit the Projects section where kids can submit ideas for things they wish would be invented and post sketches of their own creations.

InventNow (inventnow.org)

InventNow is a place for kids to submit their great invention ideas and check out other kids' ideas online.

The Lemelson Center for the Study of Invention and Innovation

(invention.smithsonian.org)

This Web site offers many different resources to boost kids' creativity and help them understand the role that invention and innovation play in U.S. history.

Howtoons (howtoons.com)

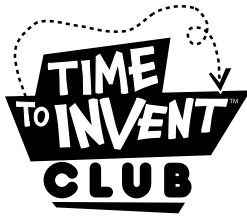
A cartoon format guides kids through 15 fun build-it-yourself projects.

TIME TO INVENT is funded by

the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH.



Maneras de seguir inventando

PROGRAMAS

Es hora de divertirnos combinando las ciencias, la ingeniería y la inventiva.

Primera liga de LEGO (usfirst.org/community/fll)

En este programa de robótica, los niños colaboran para resolver un desafío de la vida real y construir un robot.

Competencia de la ciudad del futuro (futurecity.org)

Competencia de equipos auspiciada por un maestro. Niños de grados 6 a 8 trabajan con un mentor para diseñar una ciudad del futuro.

Odisea de la mente (odysseyofthemind.com)

Este programa educativo de estilo competencia les ofrece a estudiantes de todas las edades oportunidades para resolver problemas.

Olimpiadas de ciencias (soinc.org)

Este es un torneo científico para equipos de estudiantes de los grados 6 a 12. Ofrece una Olimpiada de ciencias elemental para niños menores (entre el jardín infantil y el grado 5).

Si en la localidad hay niños o niñas que participan en Girl Scouts o Boy Scouts, ellos tienen los siguientes recursos sobre invenciones:

Girl Scouts (girlscouts.org/program/program_opportunities/science) Las niñas inscritas en Girl Scouts pueden participar en un sinnúmero de programas que se concentran en STEM (ciencias, tecnología, ingeniería y matemática) y en robótica.

Boy Scouts (scouting.org/sitecore/content/Home/BoyScouts/AdvancementandAwards/MeritBadges/mb-inventing.aspx) Para ganarse sus insignias de mérito, los niños inscritos en Boy Scouts deben hallar soluciones creativas a problemas de la vida real.

CONCURSOS

Participa en estas competencias divertidas que tienen que ver con invenciones.

BKFK (De niños para niños) (bkfk.com)

BKFK dirige retos de invención divertidos en los que los niños compiten por premios.

The Christopher Columbus Awards (christophercolumbusawards.com)

Este concurso nacional de desafíos para alumnos de escuela intermedia identifica un problema en la comunidad y crea una solución novedosa.

CAMPAMENTOS DE VERANO

Explora nuevas oportunidades en estos campamentos de verano.

Camp Invention (invent.org/camp)

En este programa de campamento diurno en el verano, los niños hacen actividades de inventiva en las que resuelven problemas de manera creativa y perfeccionan sus destrezas de razonamiento analítico.

American Society of Mechanical Engineers (asme.org/Communities/Students/K12/Camps.cfm)

Usa la lista que figura en este sitio (organizada por estados) para encontrar campamentos de ingeniería dirigidos a niños de todas las edades.

RECURSOS Y PROYECTOS EN INTERNET

Visita estos sitios web para hallar actividades y aprender más sobre las invenciones.

Design Squad Nation (pbskids.org/designsquadnation)

Este recurso en Internet le da vida a la ingeniería y lleva a los niños a participar en episodios, juegos, 40 desafíos de acción directa, y mucho más. Acude a la sección de Proyectos donde los niños pueden proponer ideas de cosas que quisieran ver inventadas y donde pueden mostrar dibujos de sus creaciones.

InventNow (inventnow.org)

InventNow es un sitio donde los niños pueden enviar sus ideas de invenciones y al mismo tiempo pueden ver las ideas de invención de otros niños.

El Centro Lemelson para el estudio de invenciones e innovaciones

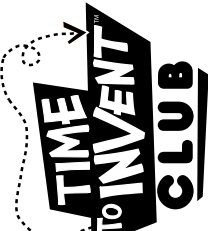
(invention.smithsonian.org)

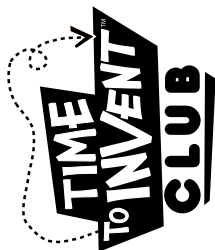
Este sitio web ofrece toda una variedad de recursos para despertarles la creatividad a los niños y ayudarles a entender el papel que las invenciones y las innovaciones han desempeñado en la historia de Estados Unidos y el mundo.

Howtoons (howtoons.com)

Un formato de tiras cómicas orienta a los niños en 15 proyectos en los que ellos pueden construir de todo, de principio a fin.

Education Standards

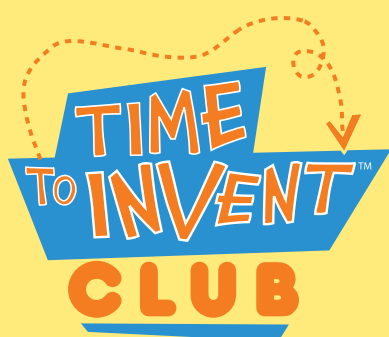
National Science Education Standards	Grades 5-8	Science in Personal & Social Perspectives								•	•								
		Science and Technology		•	•	•	•	•	•	•	•	•	•	•	•	•	•		
		Physical Science		•	•	•	•	•		•	•				•	•			
ITEEA National Study of Technology Content Standards	Grades K-12	Abilities for a Technological World	12		•	•		•	•		•	•			•	•			
			11	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
		9	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
		8	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
		2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
		1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
		Massachusetts Curriculum Frameworks Science and Technology/Engineering Standards	Grades 6-8	Engineering Design	2.5						•	•							
					2.4		•	•	•	•		•	•	•	•		•		
					2.3		•		•								•		
					2.2		•	•	•	•		•	•					•	•
2.1	•				•	•	•	•	•	•	•	•	•	•	•	•	•		
1.2				•	•														
1.1				•		•	•		•	•		•			•				
11					•					•	•								
1				•							•								
Grades 3-5	Physical Science			7							•						•		
				6							•						•		
			5							•						•			
			4							•						•			
			1							•						•			
	2.2		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	2.1					•	•												
	1.2			•	•	•	•				•					•	•		
	1.1					•	•									•	•		
					1. Club Launch														
					2. Trophy Tower														
				3. Hit the Target															
				4. Paper Bridge-Paper Chair															
				5 & 6. Green Loungers															
				7. Buzz Board															
				9. Rapid Response															
				10. Rescue 911															
				11. Pinball Party															
				12. Newspaper Clothes															
				13. Circuit Board															
				14. FUN-Raising Games															
				15. Game Day															



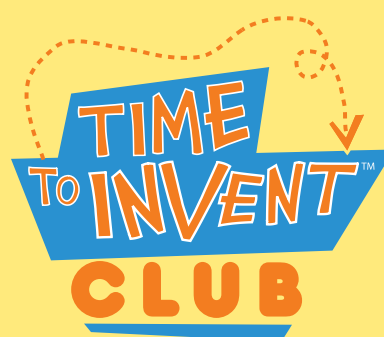


At the end of each meeting, give each kid a sticker to put in the grid on the back of the card. Choose your own stickers or use 1/2-inch round stickers, available at office supply stores.

Membership cards can get lost easily. Distribute them at the start of each meeting. Collect them at the end of every meeting.



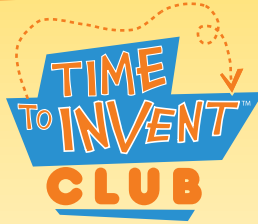
Club Member



Club Member

PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE
PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE

PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE
PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE	PLACE STICKER HERE



CERTIFICATE OF ACHIEVEMENT

Congratulations

for doing a fantastic job as an inventor
in the Time to Invent club! Your amazing ideas,
teamwork, and energy really paid off.

Thanks for helping to make the club
such a great place to be!

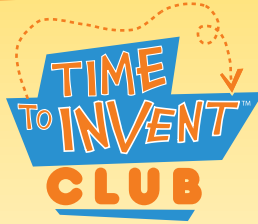
Signed,

Your Club Leaders and Co-inventors

TIME TO INVENT is funded by
the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT, and associated logos are
trademarks of WGBH.



CERTIFICADO DE ÉXITO

¡Felicitaciones!

**Por haber hecho algo fantástico como
inventor del club Time to Invent.
Tus ideas maravillosas, tu trabajo en equipo
y la cantidad de energía que aportaste
nos ayudaron muchísimo.**

**Gracias por contribuir a que el club
sea un sitio tan extraordinario.**

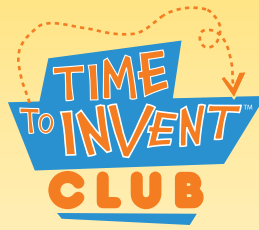
Firmado por,

Los líderes del club y tus coinventores

El financiamiento de TIME TO INVENT CLUB proviene de la
the Lemelson foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD
NATION, TIME TO INVENT y el logotipo asociado son
marcas registradas de WGBH.



MENTOR AWARD

Thank you

for sharing your expertise with the
Time to Invent club members!
Your contribution will help keep
kids involved with STEM.

Thanks for making the club so great
from all of us at the *Time to Invent*
club headquarters.

Credits

Time to Invent is produced by the WGBH Educational Outreach Department.

Director, Educational Outreach

Julie Benyo

Associate Director, Educational Outreach

Thea Sahr

Educational Content Manager

Sonja Latimore

Editorial Project Director

Chris Randall

Senior Outreach Project Director

Susan Buckey

Outreach Coordinator

Liza Silverman

Special Projects Assistant

Alannah Sharry

Writers

Joan Epstein

Hopping Fun Creations

Chris Randall

Lisa Rudy

Hanna Schonthal

Alannah Sharry

Advisors

Aline Dallaire

SACC Site Director

Edward Everett Elementary School
Dorchester, MA

Leigh Estabrooks

Invention Education Officer
Lemelson-MIT Program
Massachusetts Institute of
Technology

Yoneco Evans

Director, Education Programs
Center for Afterschool Education
Moorestown, NJ

Maryellen Hansen

Educational Consultant

Robert V. Lange, Ph.D.

Physics Professor Emeritus
Brandeis University
Waltham, MA

Jean E. Rhodes, Ph.D.

Professor

Department of Psychology
University of Massachusetts
Boston

Joshua Schuler

Executive Director

Lemelson-MIT Program
Massachusetts Institute of
Technology

Nina Vansuch

Senior Team Leader

Sumner Boys & Girls Club

Charles Sumner Elementary School
Roslindale, MA

Associate Creative Director

Peter Lyons

Designers

Dennis O'Reilly

Meryl Brenner

Illustrators

Bot Roda

Stephen Schudlich (p. 24)

Photographer

Alannah Sharry

Print Production

Lenore Lanier Gibson

Special thanks to the kids and staff at the following afterschool sites, who tested the activities and gave them their stamp of approval:

- Hosmer Elementary Afterschool, Watertown, MA
- Oak Square YMCA, Brighton, MA
- Watertown Boys and Girls Club, Watertown, MA
- West End House Boys and Girls Club, Allston, MA
- Winship Elementary School, Brighton, MA

TIME TO INVENT is funded by

the **Lemelson** foundation
improving lives through invention



©2011 WGBH Educational Foundation. DESIGN SQUAD NATION, TIME TO INVENT, and associated logos are trademarks of WGBH. All third party trademarks are the property of their respective owners.